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Chen et al.

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(54) **IMAGE CAPTURING LENS SYSTEM,
IMAGE CAPTURING APPARATUS AND
ELECTRONIC DEVICE**

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G02B 13/00 (2006.01)
G02B 1/04 (2006.01)
G02B 27/00 (2006.01)

(52) **U.S. Cl.**
CPC **G02B 13/0045** (2013.01); **G02B 1/041**
(2013.01); **G02B 9/62** (2013.01); **G02B**
27/0025 (2013.01)

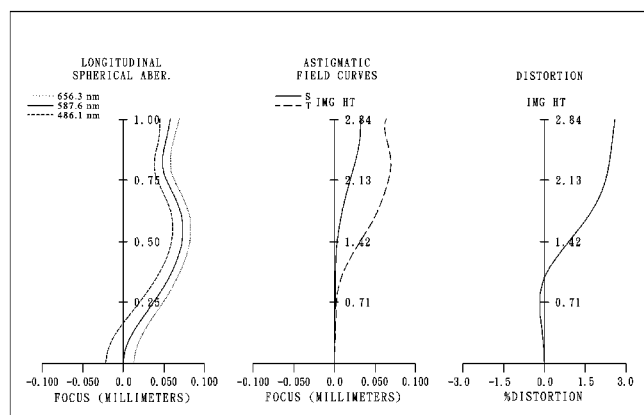
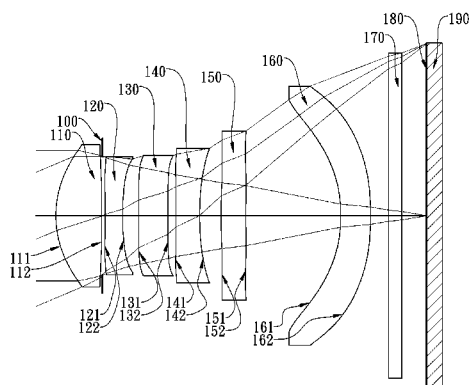
(58) **Field of Classification Search**
CPC **G02B 13/0045**; **G02B 9/62**; **G02B 1/041**;
G02B 27/0025

See application file for complete search history.

(57) **ABSTRACT**

An image capturing lens system includes, in order from an object side to an image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element having an object-side surface and an image-side surface which are both aspheric; a fourth lens element with negative refractive power having an object-side surface and an image-side surface which are both aspheric; a fifth lens element having an object-side surface and an image-side surface which are both aspheric; and a sixth lens element having a concave object-side surface and a convex image-side surface which are both aspheric. With such arrangements, the convergent capability is mainly contributed from the object side of the lens assembly for higher portability of the lens system. Additionally, the peripheral image curve can be prevented while correcting the chromatic aberration and the peripheral image focus.

27 Claims, 21 Drawing Sheets



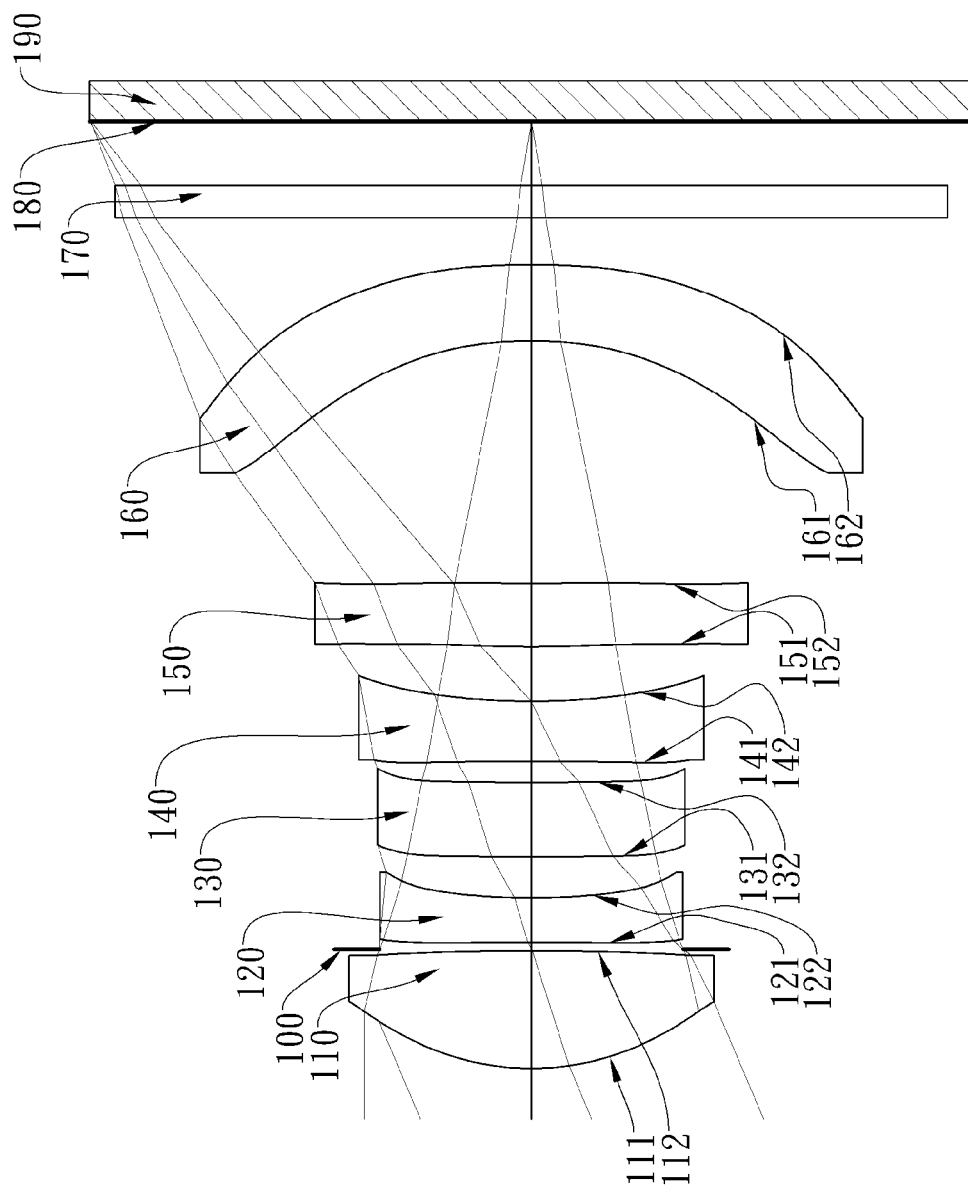


Fig. 1A

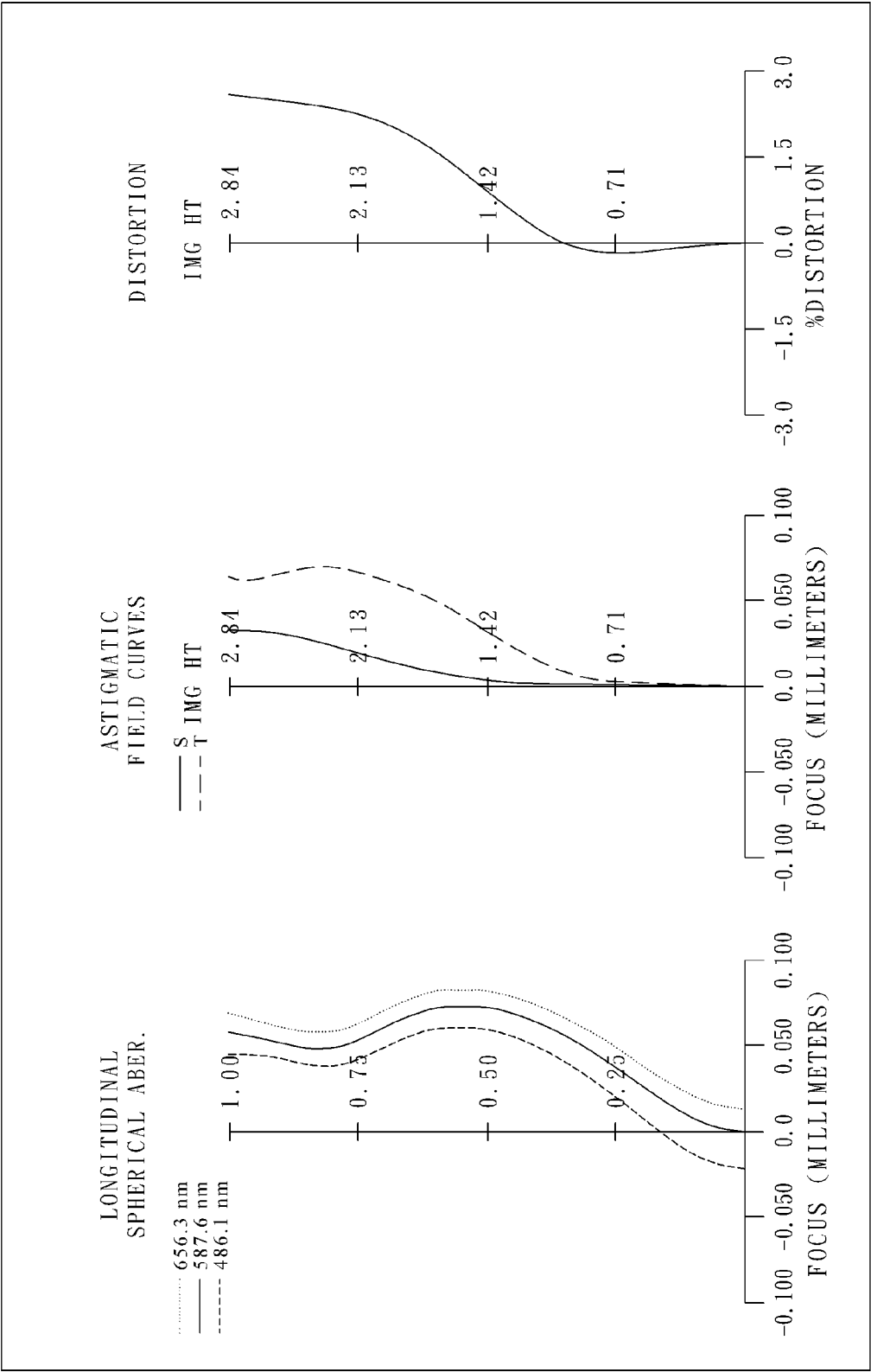


Fig. 1B

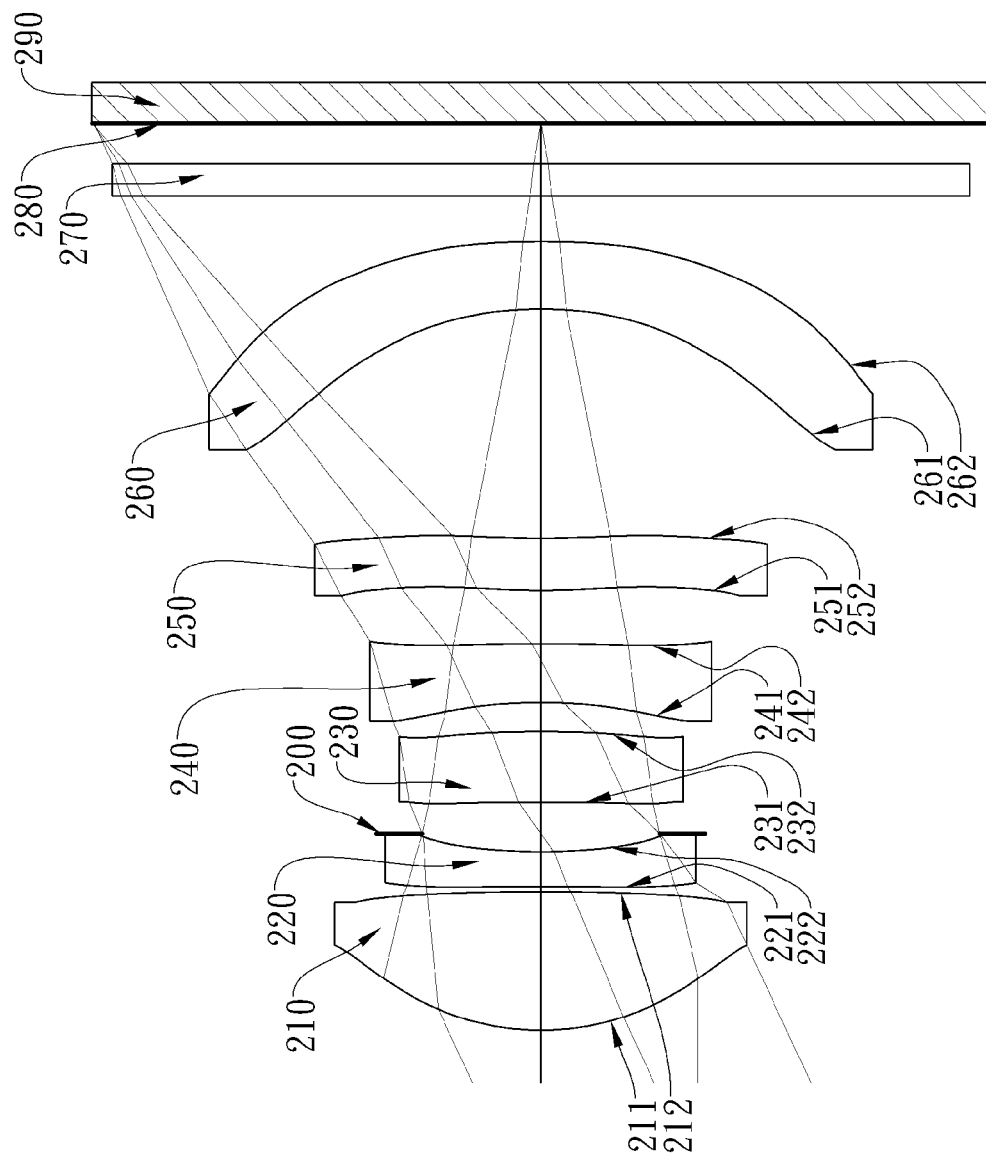


Fig. 2A

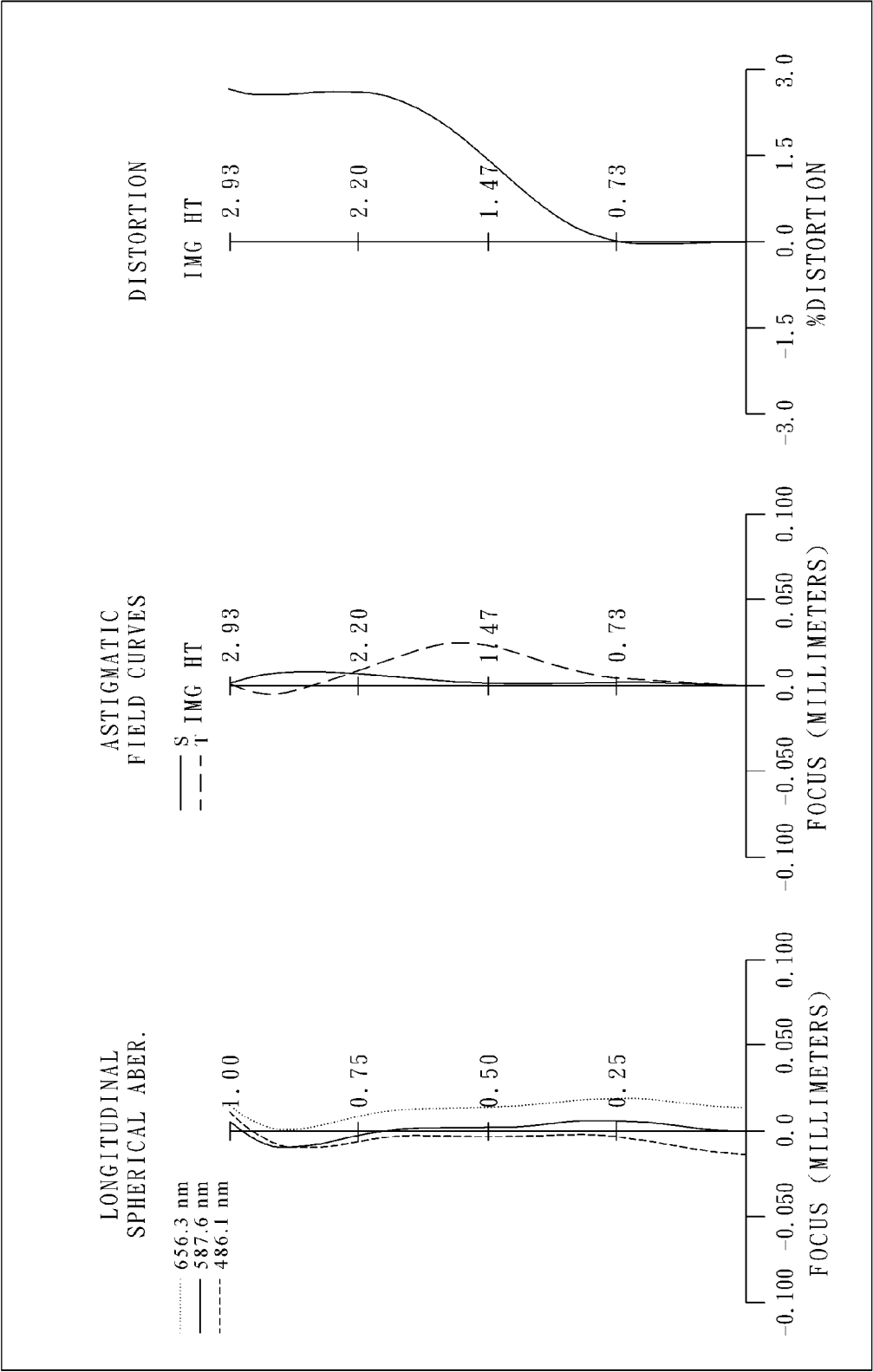


Fig. 2B

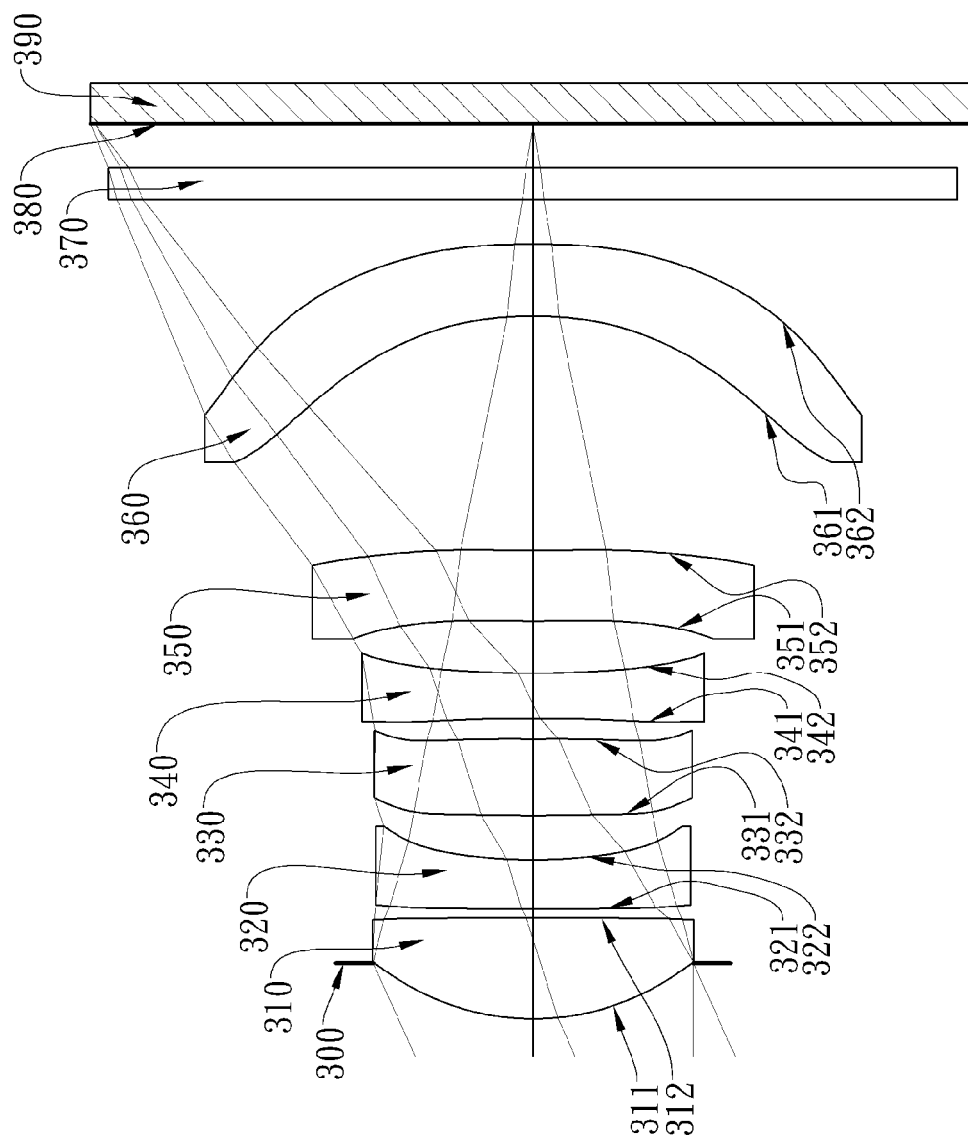


Fig. 3A

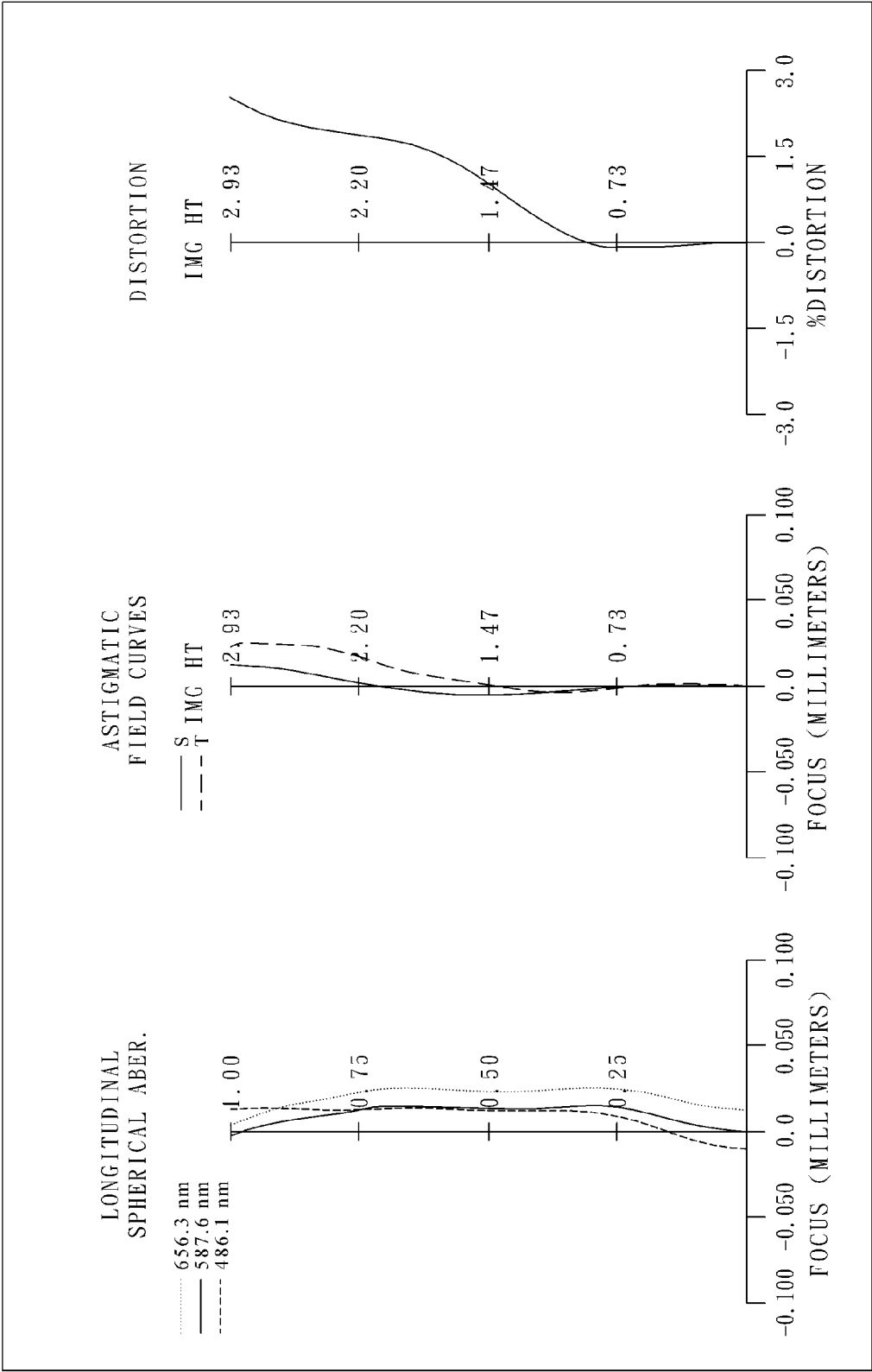


Fig. 3B

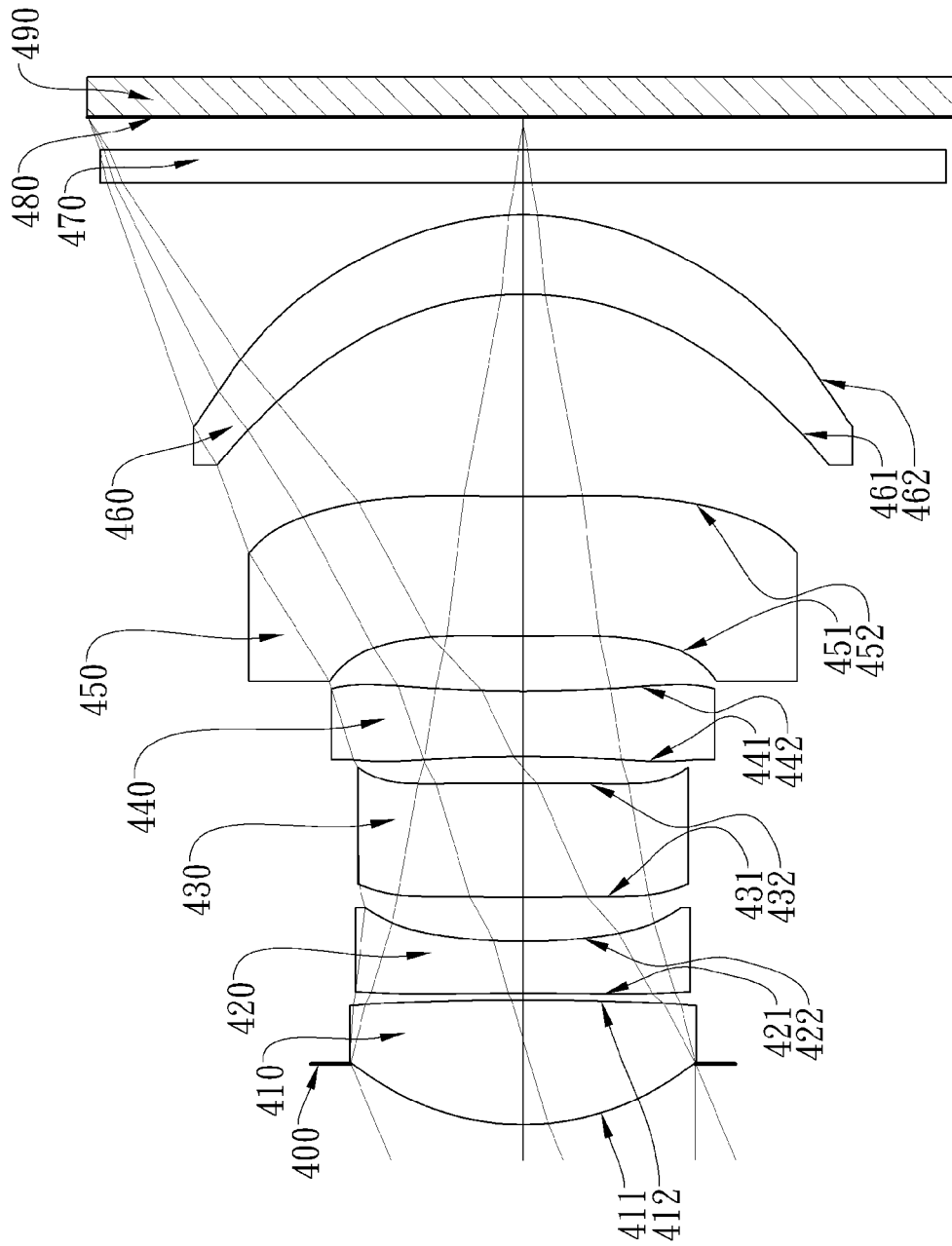


Fig. 4A

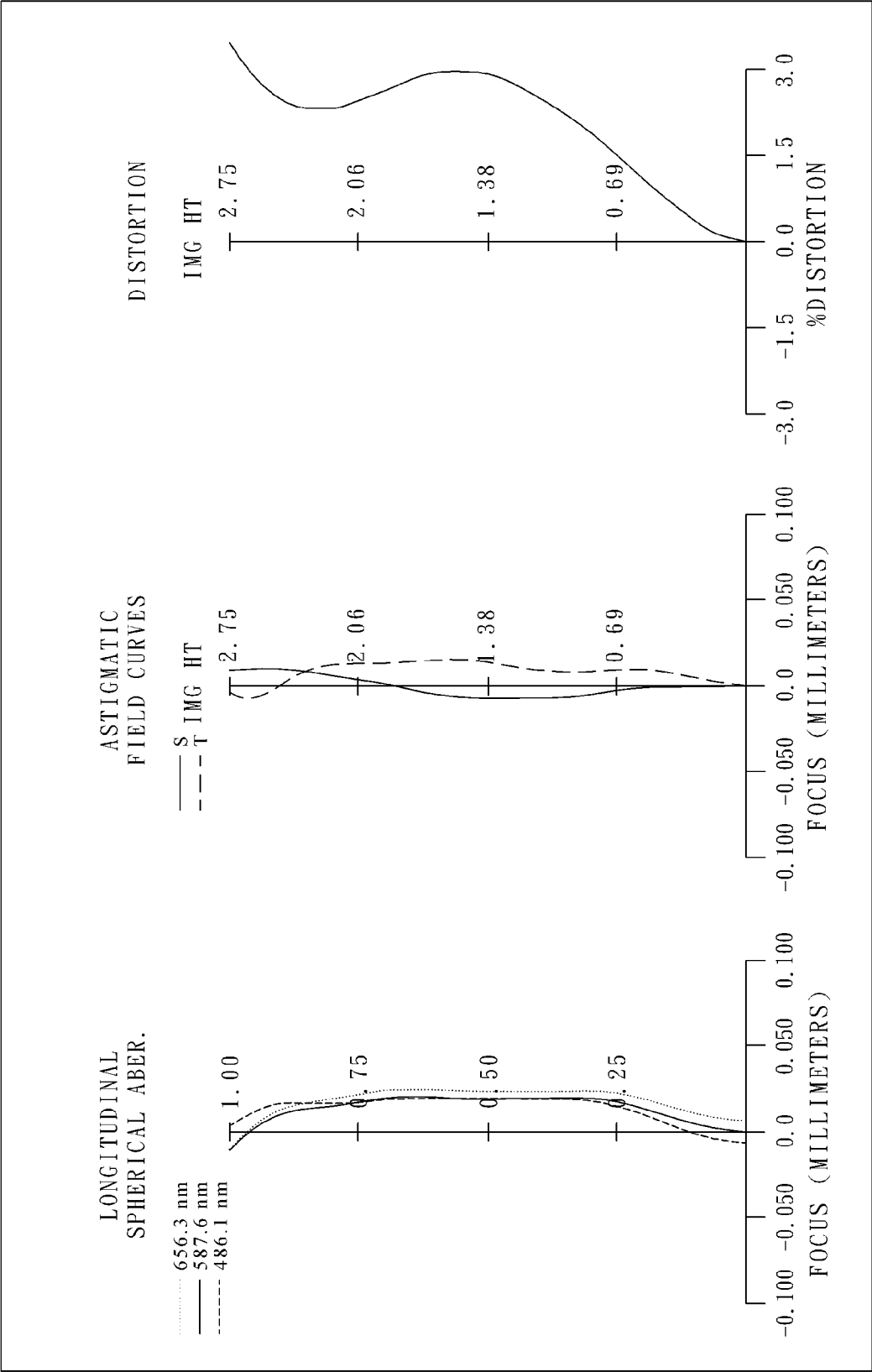


Fig. 4B

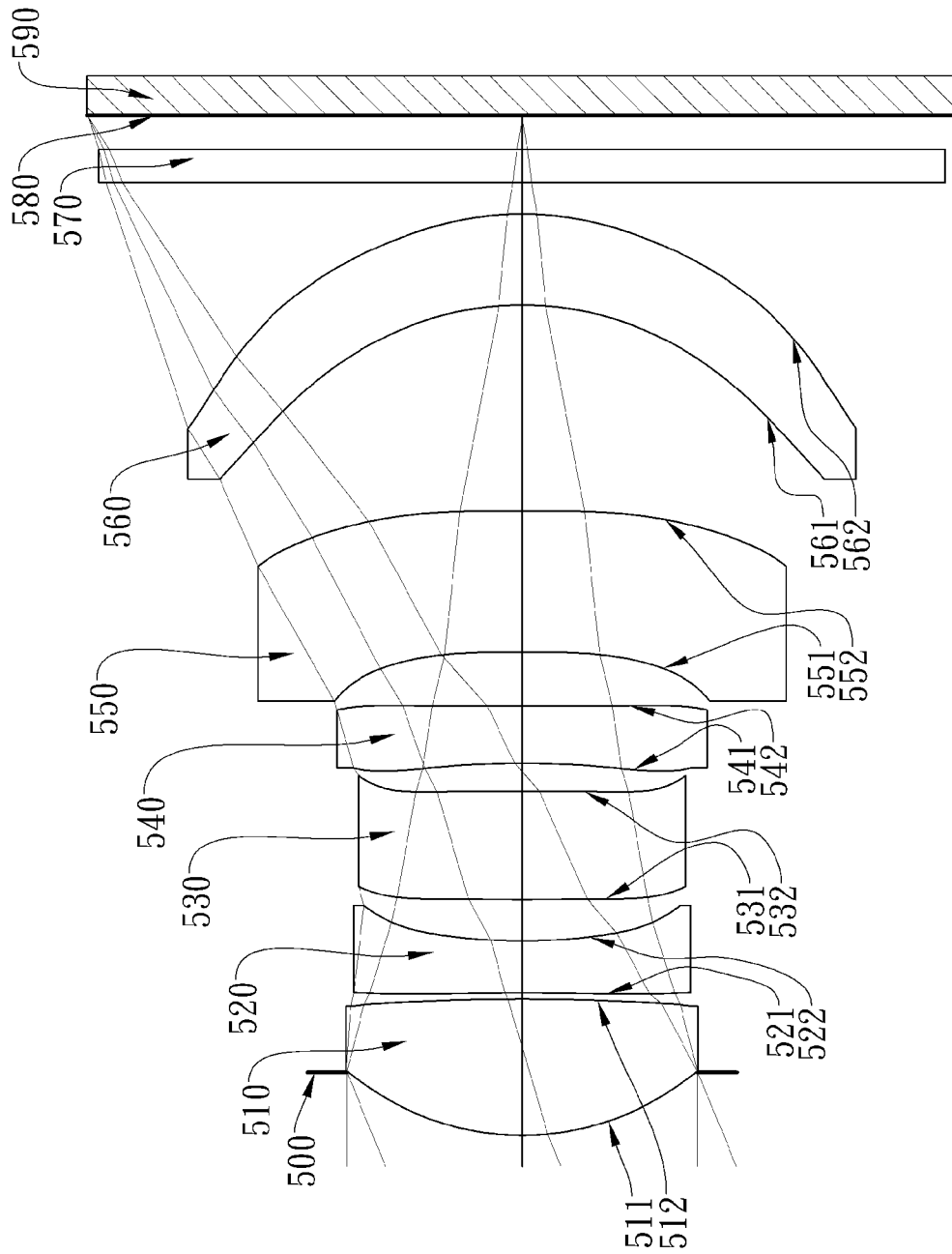


Fig. 5A

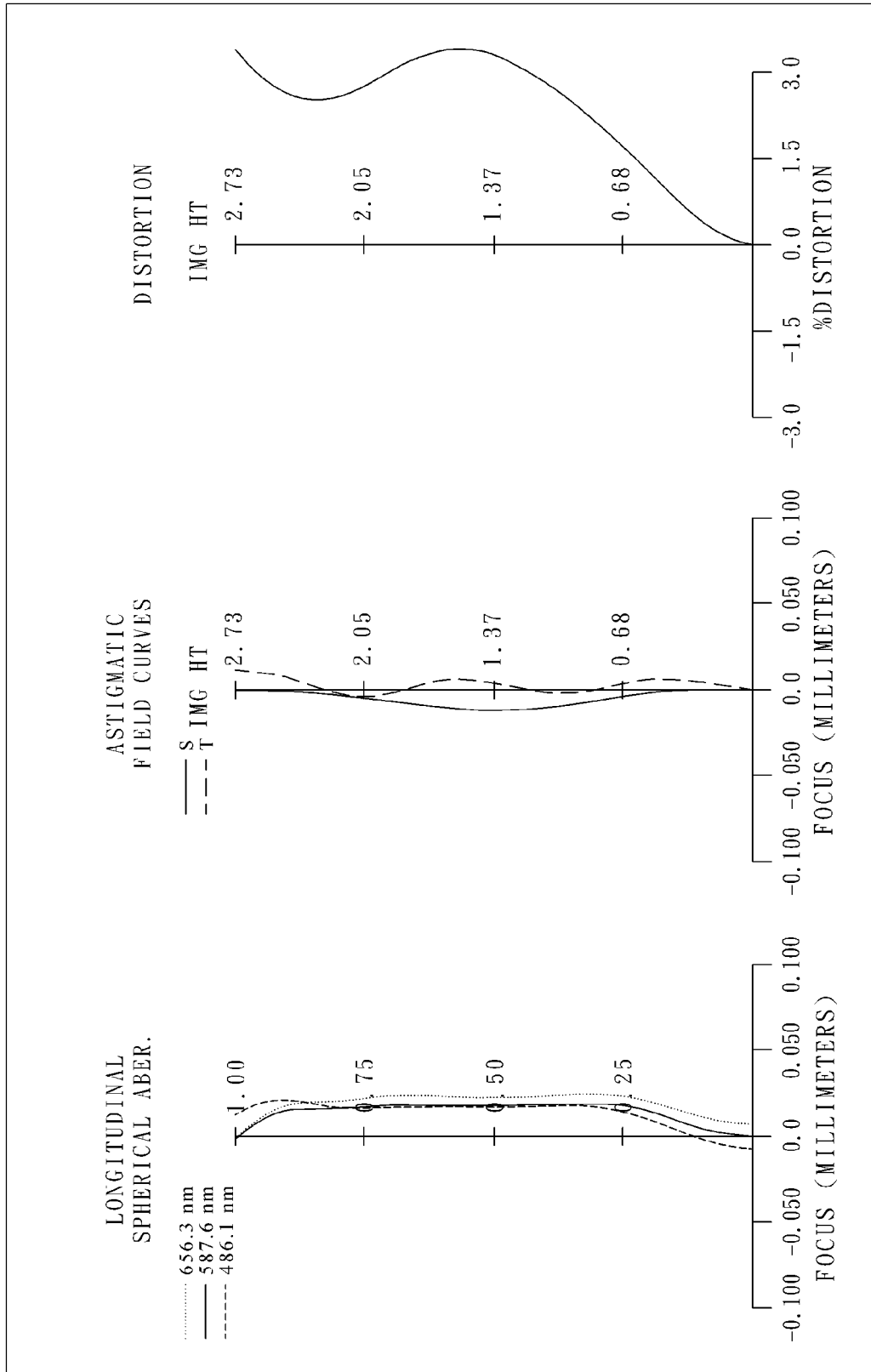


Fig. 5B

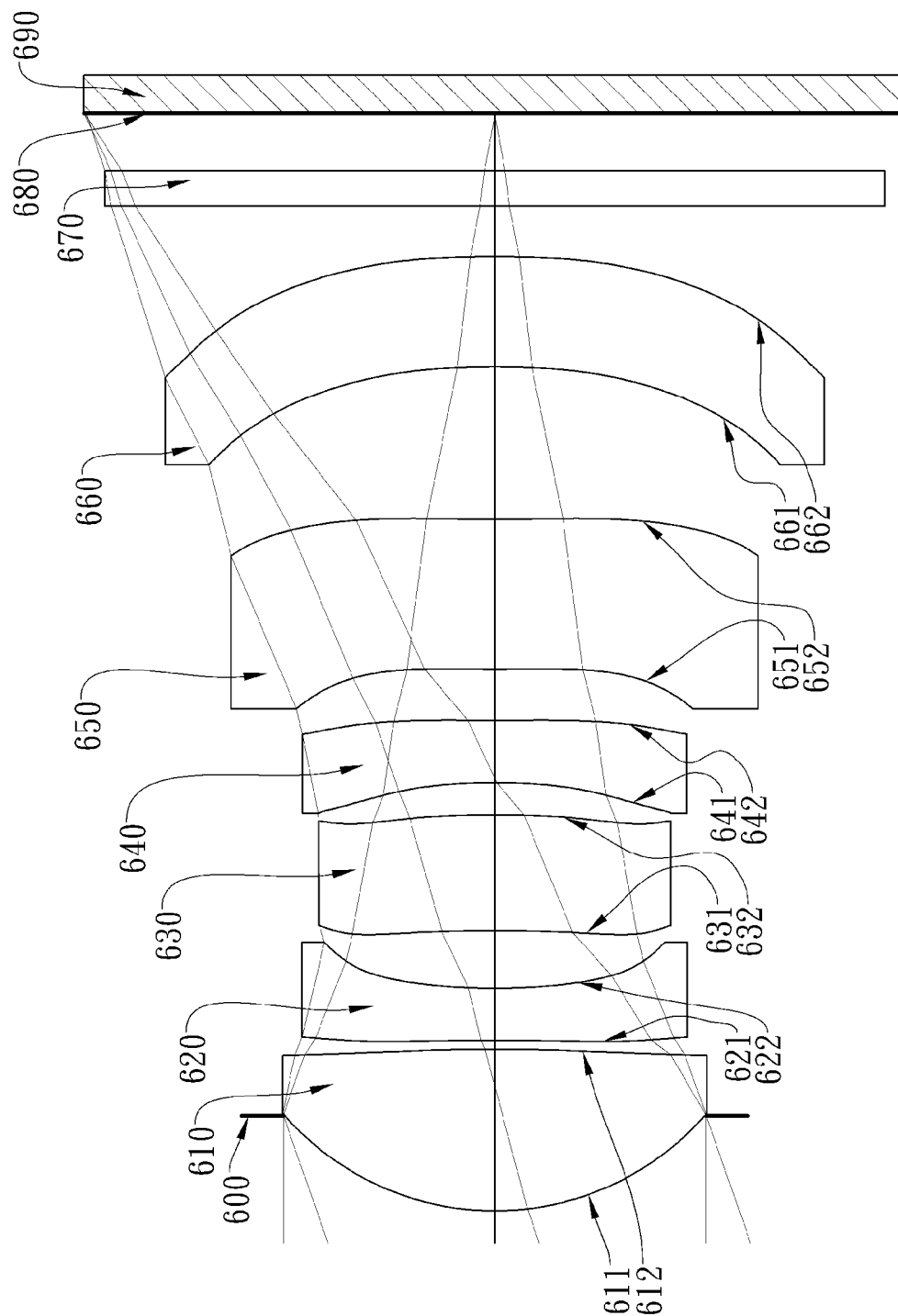


Fig. 6A

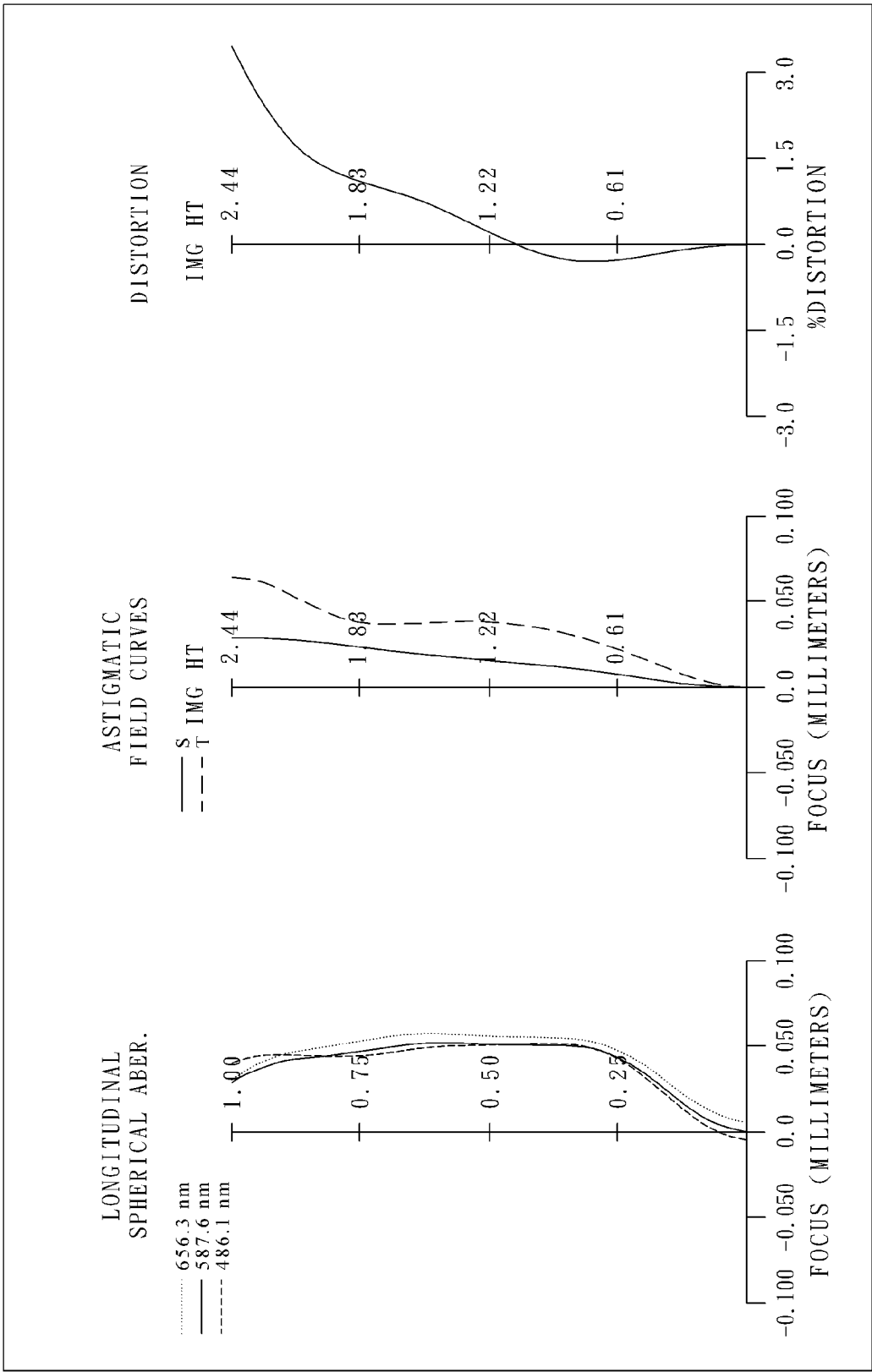


Fig. 6B

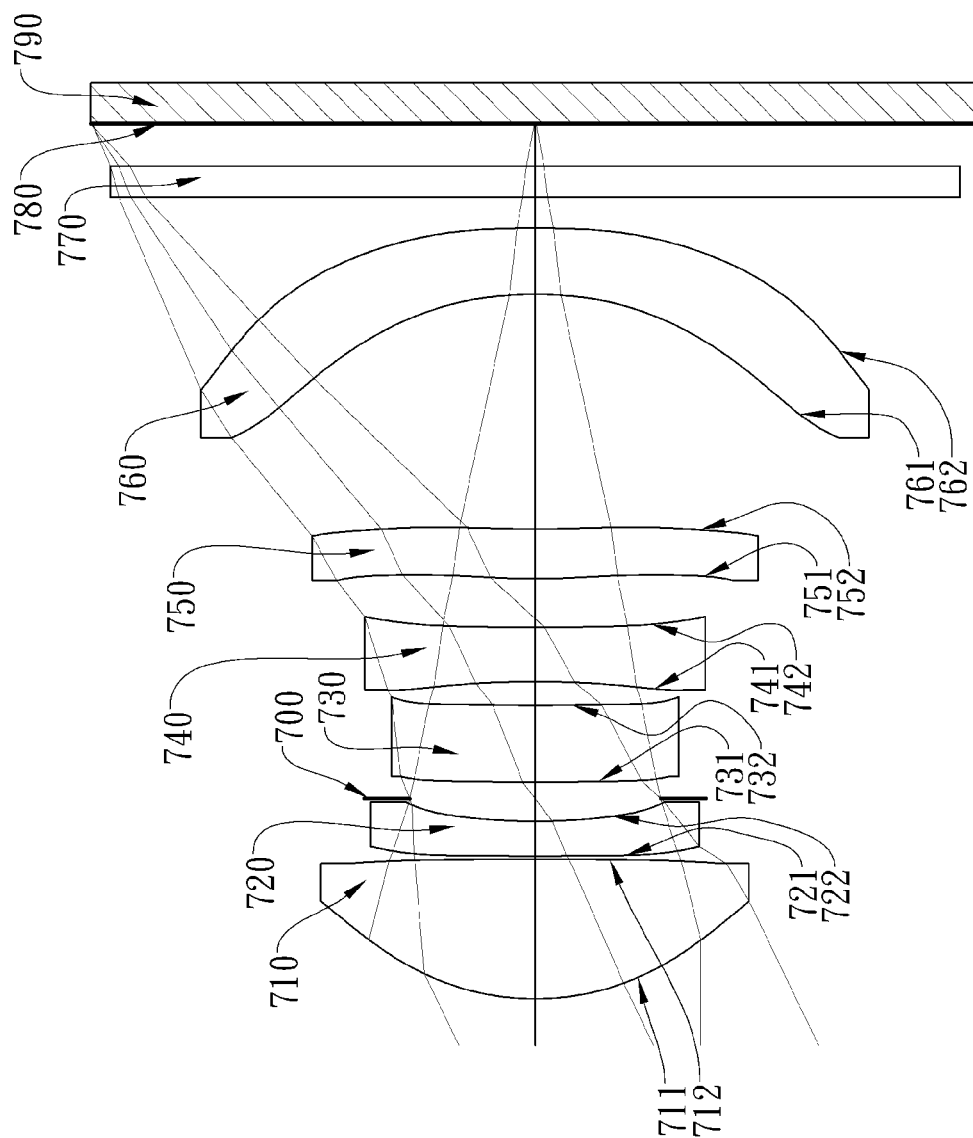


Fig. 7A

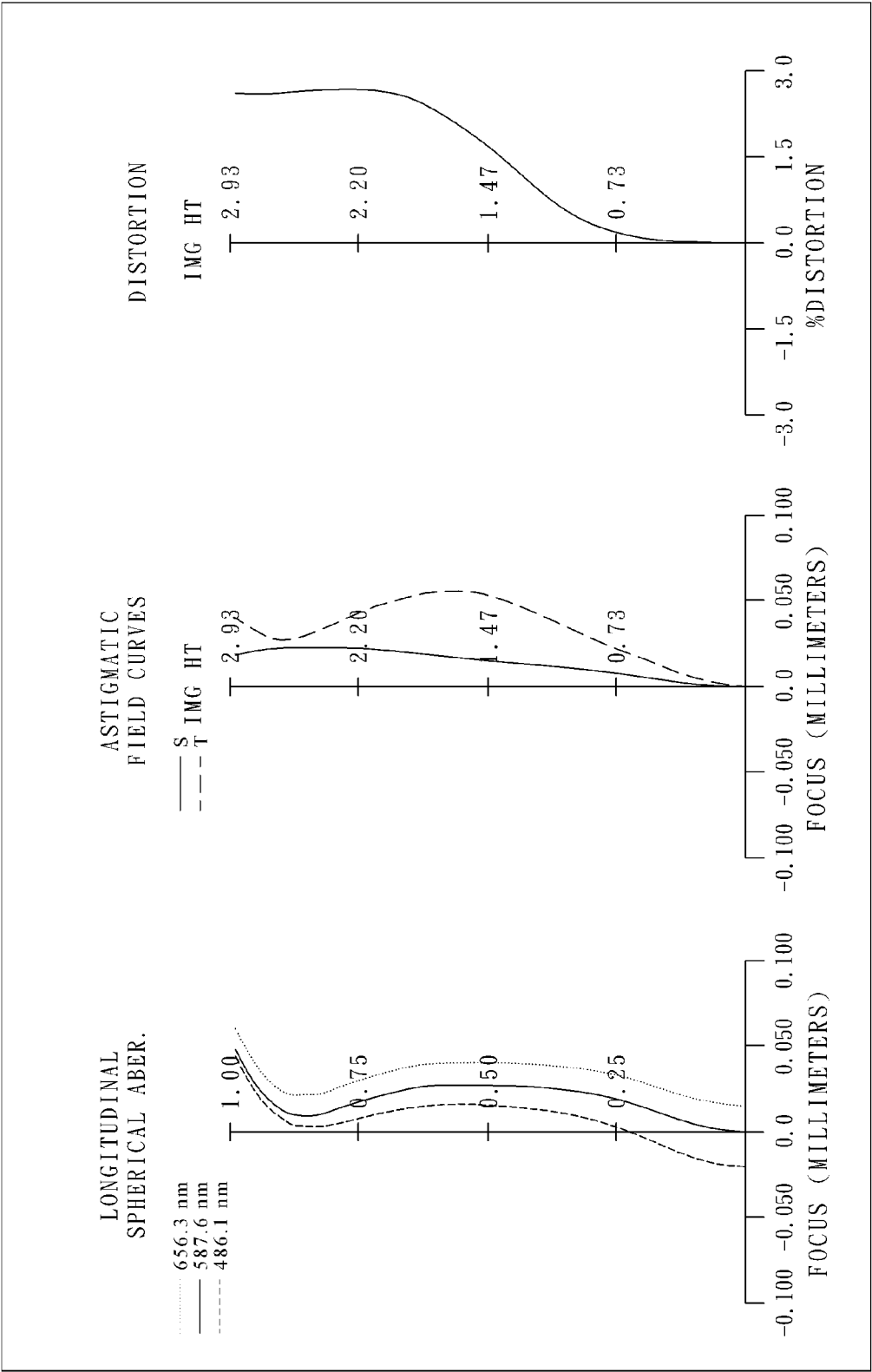


Fig. 7B

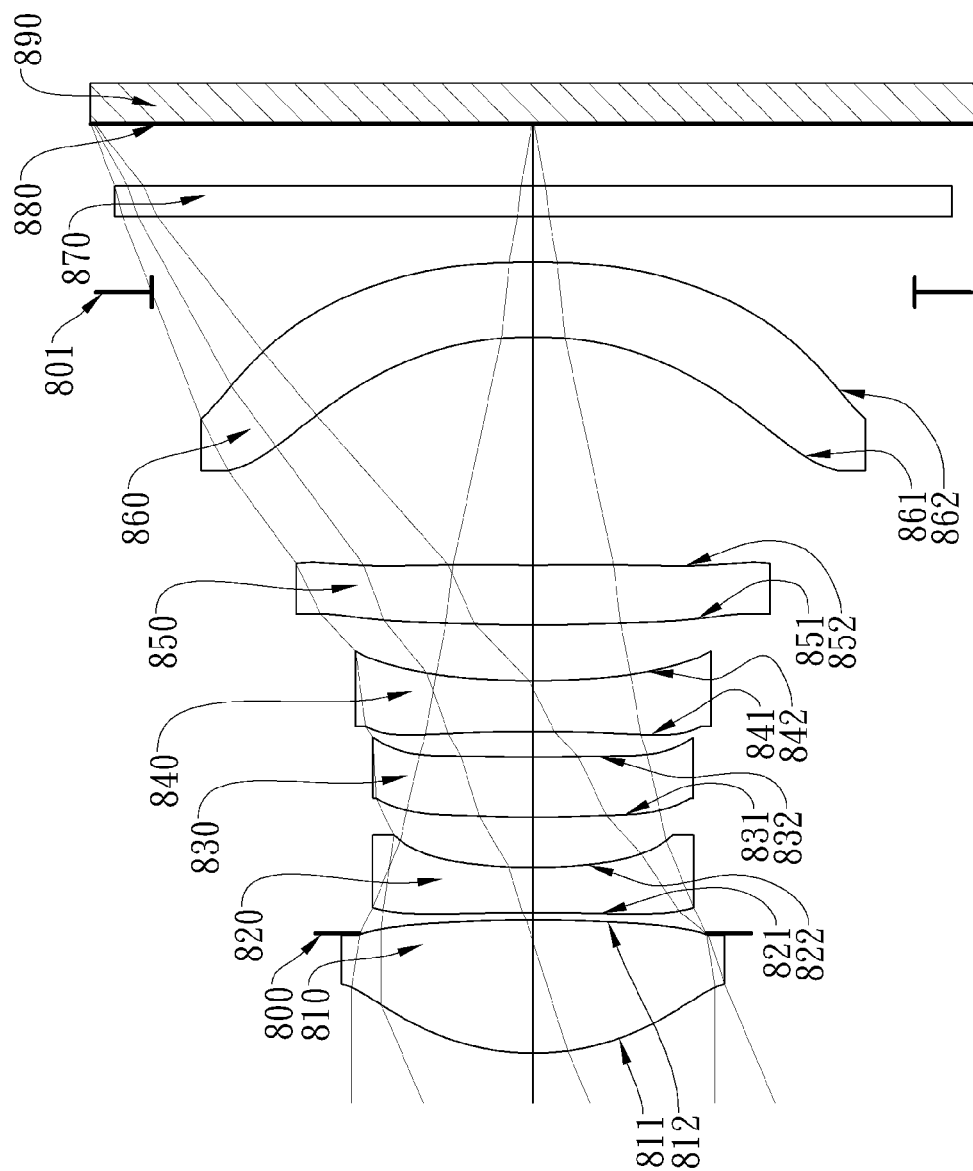


Fig. 8A

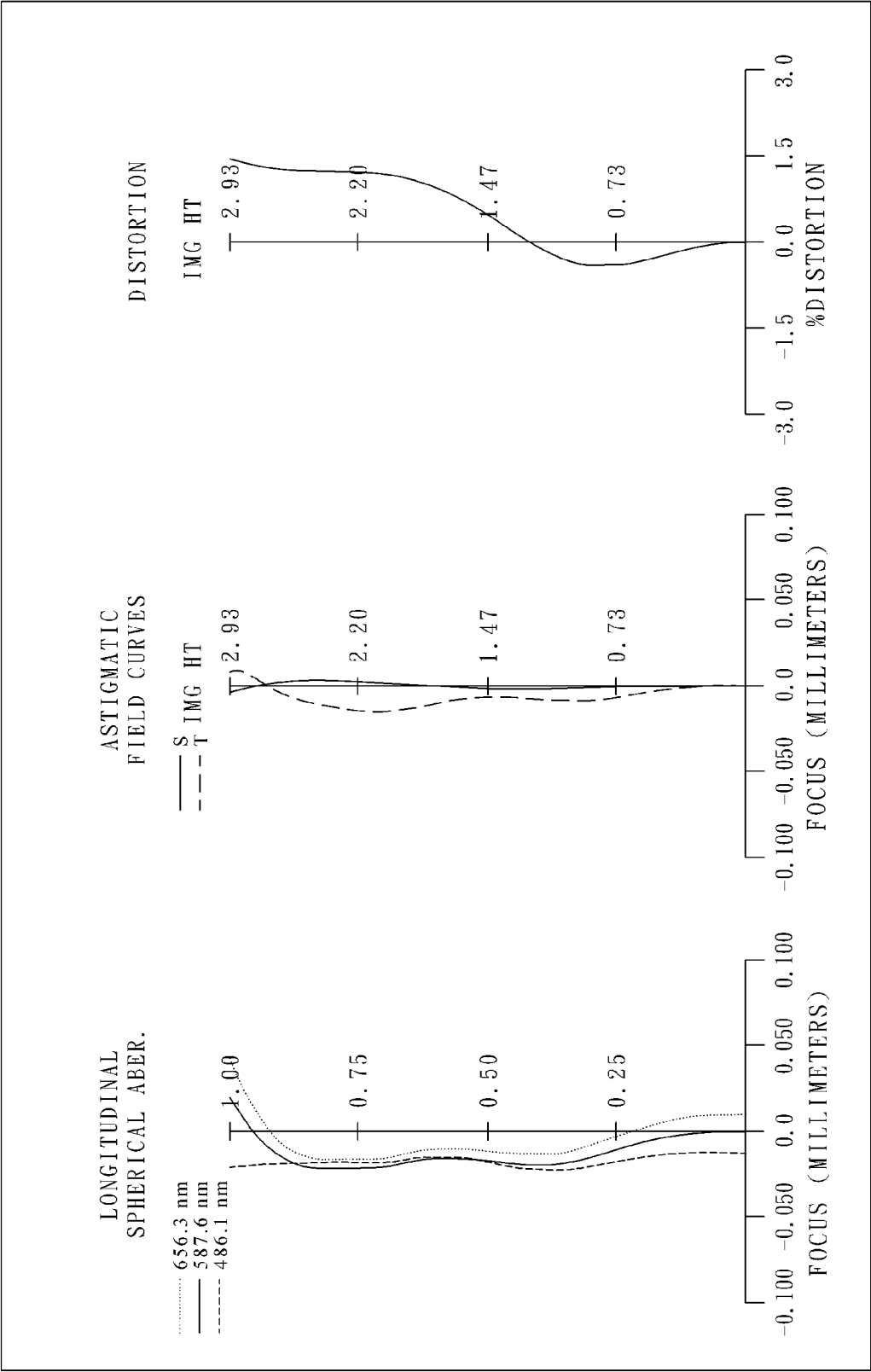


Fig. 8B

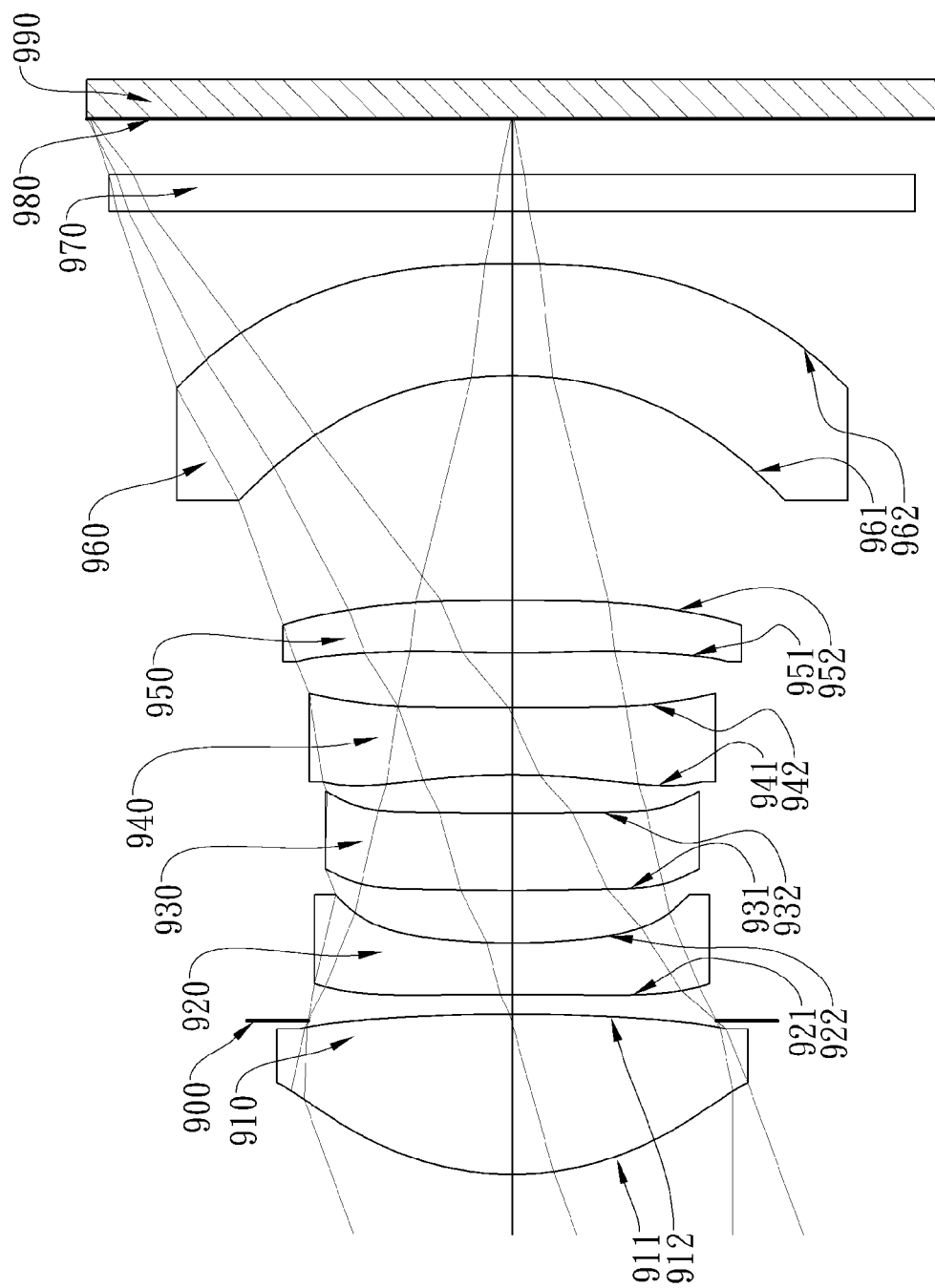


Fig. 9A

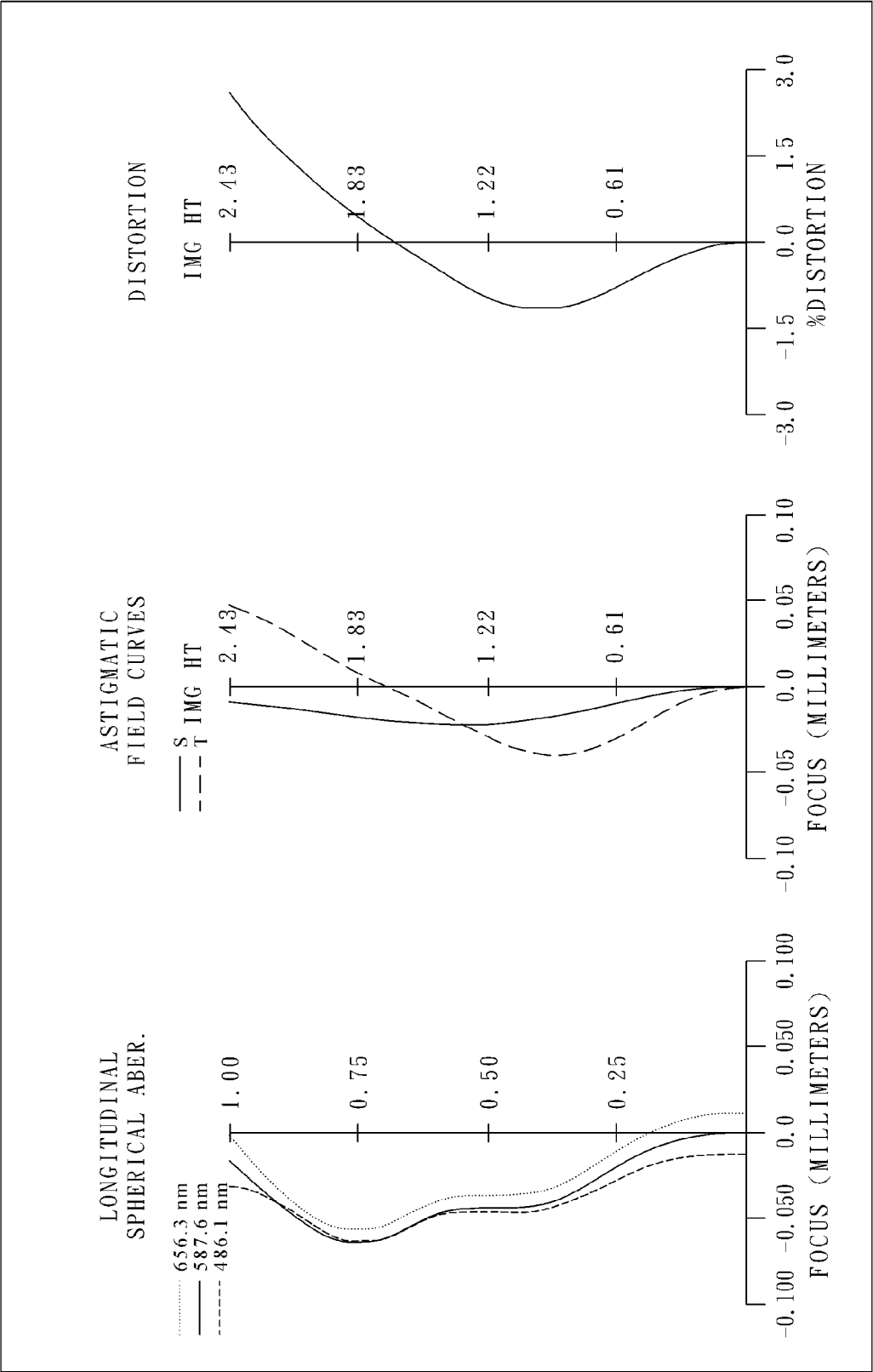


Fig. 9B

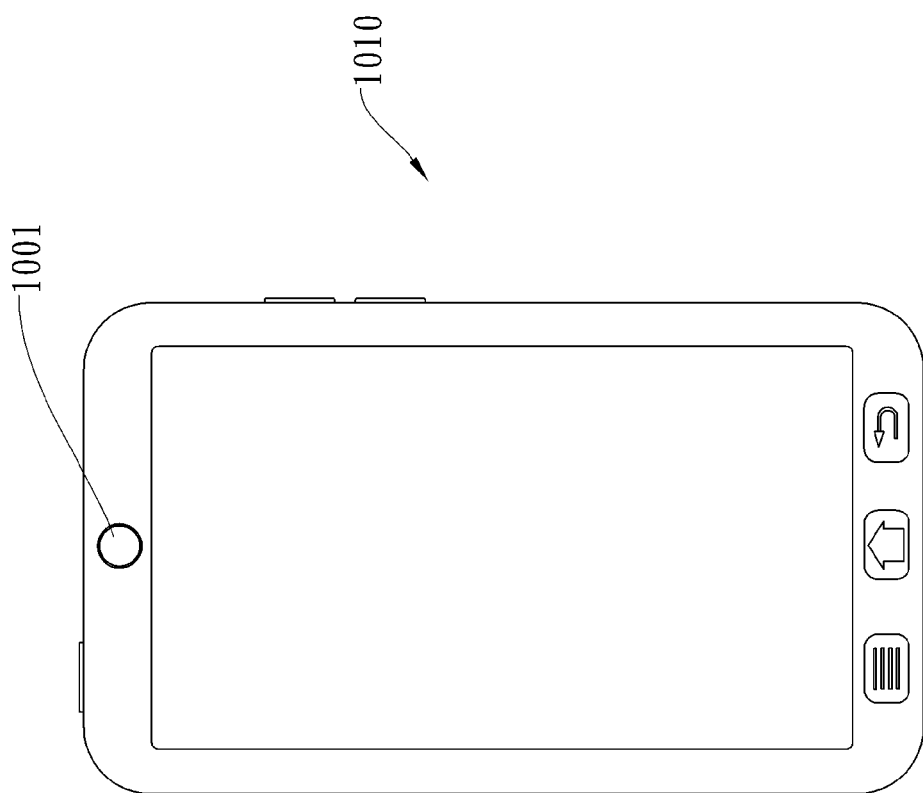


Fig. 10A

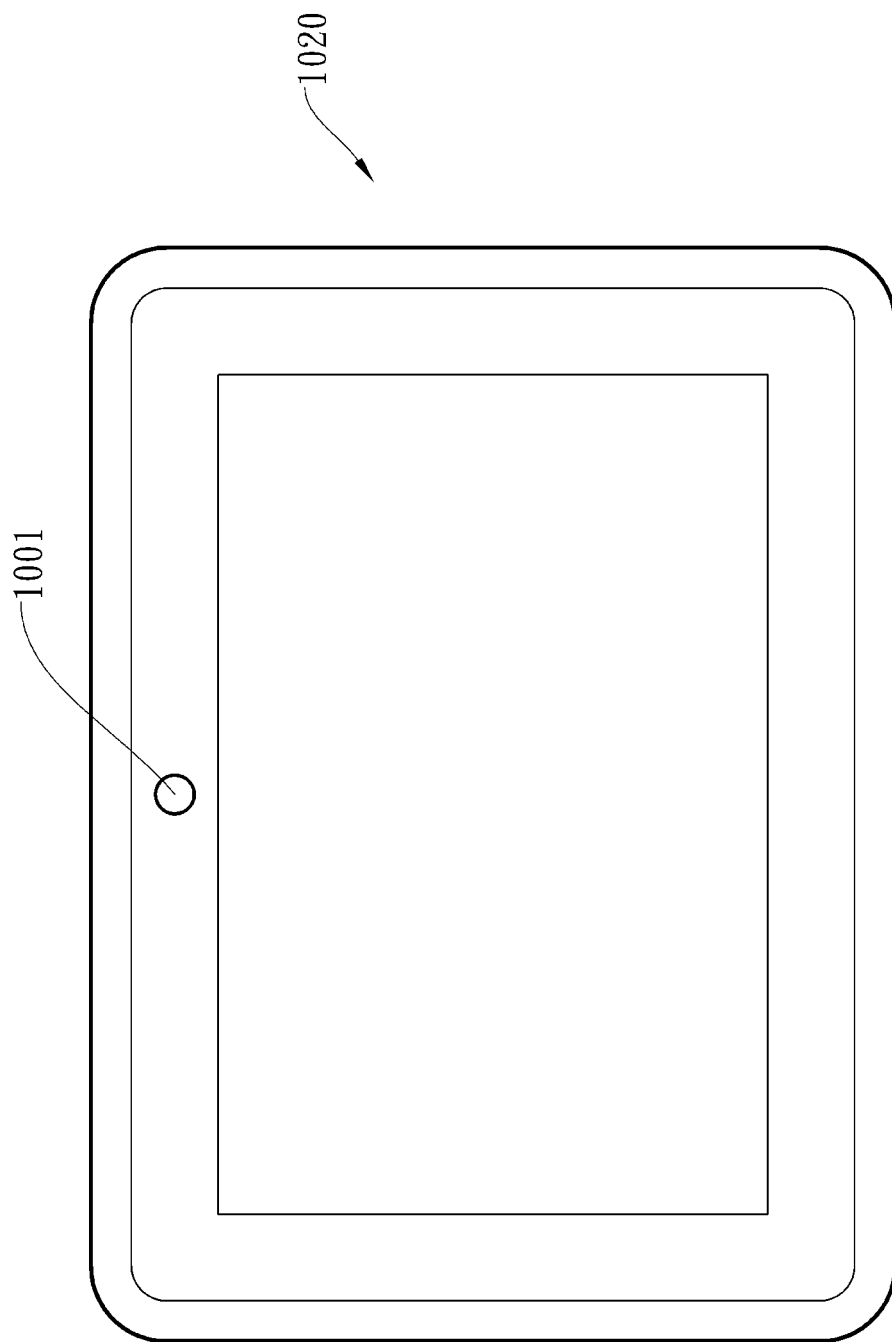


Fig. 10B

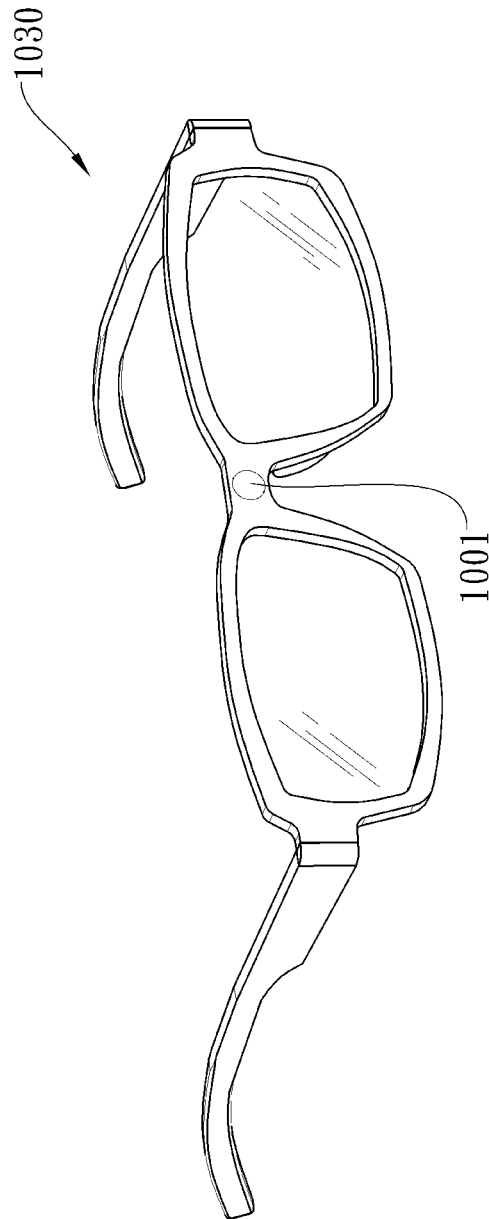


Fig. 10C

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IMAGE CAPTURING LENS SYSTEM, IMAGE CAPTURING APPARATUS AND ELECTRONIC DEVICE

RELATED APPLICATIONS

This application claims priority to Taiwan Application Serial Number 104121621, filed on Jul. 3, 2015, which is incorporated by reference herein in its entirety.

BACKGROUND

Technical Field

The present disclosure relates to an image capturing lens system and an image capturing apparatus, and more particularly, to an image capturing lens system and an image capturing apparatus applicable to electronic devices.

Description of Related Art

As personal electronic products nowadays are becoming more and more compact, the internal components of the electronic products are also required to be smaller than before, resulting in an increasing demand for compact image capturing lens systems. In addition to the demand of miniaturization, the reduction of the pixel size of image sensors in the advanced semiconductor manufacturing technologies has enabled imaging lenses to evolve toward the field of higher megapixels. Meanwhile, the popularity of smart phones and tablet personal computers boost the need for compact image capturing lens systems featuring high image quality.

Currently, most conventional lens assemblies equipped in portable electronic products have been developed for close-distance and wide field of view photography. However, the optical design of such lens assemblies cannot satisfy the need for capturing fine-detail images at long distances. A conventional telephoto optical system generally adopts a multi-element structure and comprises glass lens elements with spherical surfaces. Such a configuration not only results in a bulky lens assembly with low portability, but the high price of the product has deterred large numbers of consumers. Therefore, conventional optical systems can no longer meet consumers' needs for convenience and multiple photographing functions.

Therefore, a need exists in the art for an image capturing lens system that features a compact design and high image quality.

SUMMARY

According to one aspect of the present disclosure, an image capturing lens system includes, in order from an object side to an image side: a first lens element with positive refractive power having a convex object-side surface; a second lens element with negative refractive power; a third lens element having an object-side surface and an image-side surface which are both aspheric; a fourth lens element with negative refractive power having an object-side surface and an image-side surface which are both aspheric; a fifth lens element having an object-side surface and an image-side surface which are both aspheric; and a sixth lens element having a concave object-side surface and a convex image-side surface which are both aspheric; wherein the image capturing lens system has a total of six lens elements and an axial air gap is arranged between every two adjacent lens elements of the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element and the sixth lens element;

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wherein an axial distance between the fifth lens element and the sixth lens element is T56, a sum of axial air gaps between every two adjacent lens elements is ΣAT , a focal length of the fourth lens element is f4, a focal length of the third lens element is f3, a focal length of the image capturing lens system is f, a curvature radius of the object-side surface of the first lens element is R1, an axial distance between the image-side surface of the sixth lens element and an image surface is BL, an axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD, a central thickness of the fourth lens element is CT4, a central thickness of the fifth lens element is CT5, and the following conditions are satisfied:

$$0.30 < T56 / (\Sigma AT - T56);$$

$$-4.0 < f4 / |f3| < 0;$$

$$3.30 < f / R1 < 9.50;$$

$$0 < BL / TD < 0.70; \text{ and}$$

$$CT4 / CT5 < 3.0.$$

According to another aspect of the present disclosure, an image capturing apparatus includes the aforementioned image capturing lens system and an image sensor.

According to yet another aspect of the present disclosure, an electronic device includes the aforementioned image capturing apparatus.

The first lens element has positive refractive power so that the convergent capability is mainly contributed from the object side of the lens assembly, thereby the lens system's size can be effectively controlled to increase the portability. The second lens element has negative refractive power so as to correct the chromatic aberration of the lens system. When the fourth lens element is a negative lens element, the curving of a peripheral image can be prevented while a peripheral focus position of an image is corrected. When the object-side surface of the sixth lens element is concave, the incident angle of the light is more appropriate, thereby images are free from stray light generated due to a total reflection caused by an excessively large incident angle. When the image-side surface of the sixth lens element is convex, it is favorable for correcting the peripheral aberration of the lens system, thereby obtaining better image quality.

When $T56 / (\Sigma AT - T56)$ satisfies the above condition, the lens system will have sufficient space so as to prevent the interference between the fifth lens element and the sixth lens element, and it is favorable for the assembling of the lens assembly.

When $f4 / |f3|$ satisfies the above condition, the middle section of the lens system has sufficient light dispersion control functionalities so as to balance the aberration of the system.

When $f / R1$ satisfies the above condition, the refractive power of the first lens element can be enhanced so that the lens system is adaptable to diverse configurations and applications.

When BL / TD satisfies the above condition, the back focal length of the image capturing lens system can be favorably controlled to improve the space utilization efficiency, thereby obtaining a compact image capturing lens system.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1A is a schematic view of an image capturing apparatus according to the 1st embodiment of the present disclosure;

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FIG. 1B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 1st embodiment;

FIG. 2A is a schematic view of an image capturing apparatus according to the 2nd embodiment of the present disclosure;

FIG. 2B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 2nd embodiment;

FIG. 3A is a schematic view of an image capturing apparatus according to the 3rd embodiment of the present disclosure;

FIG. 3B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 3rd embodiment;

FIG. 4A is a schematic view of an image capturing apparatus according to the 4th embodiment of the present disclosure;

FIG. 4B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 4th embodiment;

FIG. 5A is a schematic view of an image capturing apparatus according to the 5th embodiment of the present disclosure;

FIG. 5B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 5th embodiment;

FIG. 6A is a schematic view of an image capturing apparatus according to the 6th embodiment of the present disclosure;

FIG. 6B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 6th embodiment;

FIG. 7A is a schematic view of an image capturing apparatus according to the 7th embodiment of the present disclosure;

FIG. 7B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 7th embodiment;

FIG. 8A is a schematic view of an image capturing apparatus according to the 8th embodiment of the present disclosure;

FIG. 8B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 8th embodiment;

FIG. 9A is a schematic view of an image capturing apparatus according to the 9th embodiment of the present disclosure;

FIG. 9B shows longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 9th embodiment;

FIG. 10A shows a smart phone with an image capturing apparatus of the present disclosure installed therein;

FIG. 10B shows a tablet personal computer with an image capturing apparatus of the present disclosure installed therein; and

FIG. 10C shows a wearable device with an image capturing apparatus of the present disclosure installed therein.

DETAILED DESCRIPTION

The present disclosure provides an image capturing lens system including, in order from an object side to an image side, a first lens element, a second lens element, a third lens element, a fourth lens element, a fifth lens element, and a sixth lens element, wherein the image capturing lens system

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has a total of six lens elements. The image capturing lens system is further provided with a stop.

In the aforementioned image capturing lens system, every two adjacent lens elements of the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element and the sixth lens element have an axial air gap in between. That is, the image capturing lens system has six non-cemented lens elements. Moreover, the manufacturing process of the cemented lens elements is more complex than that of the non-cemented lens elements. In particular, a second surface of one lens element and a first surface of the following lens element need to have accurate curvature to ensure these two lens elements will be highly cemented. However, during the cementing process, those two lens elements might not be highly cemented due to displacement and it is thereby not favorable for the image quality of the image capturing lens system. Therefore, every two adjacent lens elements among the six lens elements of the image capturing lens system of the present disclosure have an air gap in between so as to effectively avoid the problem generated by the cemented lens elements.

The first lens element has positive refractive power so that the convergent capability is mainly contributed from the object side of the lens system, thereby the lens system's size can be effectively controlled to increase the portability. The object-side surface of the first lens element is convex in a paraxial region thereof so as to adjust the distribution of the positive refractive power and thereby to enhance the miniaturization of the lens system.

The second lens element has negative refractive power so as to correct the chromatic aberration of the lens system.

The third lens element may have positive refractive power, so that the distribution of the positive refractive power of the lens system can be effectively balanced.

The fourth lens element has negative refractive power, so that the curving of a peripheral image can be prevented while the peripheral focus position of an image is corrected. The object-side surface of the fourth lens element may be concave in a paraxial region thereof and the image-side surface of the fourth lens element may be concave in a paraxial region thereof so as to favorably correct the aberration of the image capturing lens system.

The fifth lens element may have positive refractive power, so that it is favorable for reducing the spherical aberration and astigmatism near the object side and balancing the distribution of the positive refractive power. The object-side surface of the fifth lens element may be convex in a paraxial region thereof, so that the distortion of the peripheral light and the high order aberration of the image capturing lens system can be effectively corrected, thereby increasing the resolution.

The sixth lens element may have negative refractive power; this allows the principal point of the image capturing lens system to be placed away from the image surface, thereby favorably reducing the total track length of the image capturing lens system to keep the image capturing lens system compact. When the object-side surface of the sixth lens element is concave, the incident angle of the light is more appropriate, thereby images are free from stray light generated due to a total reflection caused by an excessively large incident angle. When the image-side surface of the sixth lens element is convex, it is favorable for correcting the peripheral aberration of the lens system, thereby obtaining better image quality.

When an axial distance between the fifth lens element and the sixth lens element is T56, a sum of axial air gaps between every two adjacent lens elements is ΣAT , and the following

condition is satisfied: $0.30 < T56/(\Sigma AT - T56)$, the lens system will have sufficient space so as to prevent the interference between the fifth lens element and the sixth lens element, and it is favorable for the assembly of the lens assembly. Preferably, the following condition is satisfied: $0.85 < T56/(\Sigma AT - T56)$.

When a focal length of the fourth lens element is f_4 , a focal length of the third lens element is f_3 , and the following condition is satisfied: $-4.0 < f_4/f_3 < 0$, the middle section of the lens system has sufficient light dispersion control functionalities so as to balance the aberration of the lens system. Preferably, the following condition is satisfied: $-1.5 < f_4/f_3 < 0$. More preferably, the following condition is satisfied: $-0.65 < f_4/f_3 < 0$.

When the focal length of the image capturing lens system is f , a curvature radius of the object-side surface of the first lens element is R_1 , and the following condition is satisfied: $3.30 < f/R_1 < 9.50$, the refractive power of the first lens element can be enhanced so that the lens system is adaptable to diverse configurations and applications.

When an axial distance between the image-side surface of the sixth lens element and an image surface is BL , an axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD , and the following condition is satisfied: $0 < BL/TD < 0.70$, the back focal length of the image capturing lens system can be favorably controlled to improve the space utilization efficiency so as to keep the image capturing lens system compact. Preferably, the following condition is satisfied: $0 < BL/TD < 0.30$.

When a central thickness of the fourth lens element is CT_4 , a central thickness of the fifth lens element is CT_5 , and the following condition is satisfied: $CT_4/CT_5 < 3.0$, it is favorable for molding and manufacturing the lens elements so that the image capturing lens system has good image quality. Preferably, the following condition is satisfied: $CT_4/CT_5 < 1.7$.

When a maximum refractive index among the refractive indices of the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element, and the sixth lens element is N_{max} , and the following condition is satisfied: $N_{max} < 1.70$, it is favorable for arranging suitable materials for lens elements and for increasing the flexibility in design.

At least one of the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element and the sixth lens element has at least one inflection point, so that it is favorable for correcting the system aberration of the peripheral image.

When an axial distance between the stop and the image-side surface of the sixth lens element is SD , the axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD , and the following condition is satisfied: $0.7 < SD/TD < 1.10$, it is favorable for balancing the total track length of the image capturing lens system while controlling the incident angle so as to prevent the image capturing lens system from being too bulky.

When a focal length of the first lens element is f_1 , a focal length of the second lens element is f_2 , the focal length of the fourth lens element is f_4 , a focal length of the sixth lens element is f_6 , the focal length of the third lens element is f_3 , a focal length of the fifth lens element is f_5 , and the following conditions are satisfied: $|f_1| < |f_2| < |f_4| < |f_3|$, $|f_1| < |f_2| < |f_4| < |f_5|$, $|f_1| < |f_2| < |f_6| < |f_3|$, $|f_1| < |f_2| < |f_6| < |f_5|$,

the distribution of the refractive power of the image capturing lens system is more balanced so as to meet different photographic needs.

When a curvature radius of an image-side surface of the second lens element is R_4 , a curvature radius of an object-side surface of the second lens element is R_3 , and preferably the following condition is satisfied: $-0.20 < R_4/R_3 < 0.40$, the high order aberration of the image capturing lens system can be favorably corrected to improve the image quality, and the back focal length of the image capturing lens system can be effectively suppressed to effectively utilize the space so that the lens elements of the image capturing lens system can be more tightly assembled.

When the focal length of the image capturing lens system is f , a curvature radius of the object-side surface of the sixth lens element is R_{11} , a curvature radius of the image-side surface of the sixth lens element is R_{12} , and the following condition is satisfied: $-8.0 < (f/R_{11}) + (f/R_{12}) < -1.5$, the refraction angle of the light exiting the image capturing lens system can be effectively controlled, and it is favorable for correcting the aberration of the peripheral image and for reducing the back focal length so as to reduce the lens assembly's size. Preferably, the following condition is satisfied: $-8.0 < (f/R_{11}) + (f/R_{12}) < -2.5$.

When an Abbe number of the second lens element is V_2 , an Abbe number of the third lens element is V_3 , an Abbe number of the fifth lens element is V_5 , an Abbe number of the fourth lens element is V_4 , and the following condition is satisfied: $0.70 < (V_2 + V_3 + V_5)/V_4 < 1.50$, the dispersion capability of the image capturing lens system can be enhanced to compensate for the discrepancy in the capability of converging different wavelengths of lights.

When a distance in parallel with an optical axis from an axial vertex on the image-side surface of the sixth lens element to a maximum effective radius position on the image-side surface of the sixth lens element is SAG_{62} (SAG_{62} is defined as a negative value if the aforementioned distance is measured in a direction towards the object side, and SAG_{62} is defined as a positive value if the aforementioned distance is measured in a direction towards the image side), a central thickness of the sixth lens element is CT_6 , and preferably the following condition is satisfied: $SAG_{62}/CT_6 < -1.7$, the sixth lens element will not be too curved and the thickness thereof is proper, and it is favorable not only for manufacturing and molding the lens elements but also for reducing the space required for assembling the lens elements, thereby the lens elements can be assembled more tightly.

When an Abbe number of at least one of the lens elements with positive refractive power is less than 28.0, the discrepancy in the capability of converging different wavelengths of lights can be balanced, and it is more suitable for photographing distant subjects.

When half of a maximal field of view of the image capturing lens system is $HFOV$, and the following condition is satisfied: $\tan(2 * HFOV) < 1.20$, it is favorable for providing a satisfactory telephoto function while effectively controlling the image range, thereby meeting the need for telephoto photographing.

When an axial distance between the third lens element and the fourth lens element is T_{34} , an axial distance between the fourth lens element and the fifth lens element is T_{45} , and the following condition is satisfied: $T_{34} < T_{45}$, the configuration of the fourth lens element is more appropriate, and it is favorable for assembling the lens elements and correcting the aberration of the image capturing lens system.

When the axial distance between the fifth lens element and the sixth lens element is T56, the central thickness of the fifth lens element is CT5, and the following condition is satisfied: $2.0 < T56/CT5$, the interval between the fifth lens element and the sixth lens element can be effectively increased so as to accommodate other components, thereby further controlling the amount of incident light, length of exposure time and light filtration for an image so as to enhance the image adjustment capability.

When the focal length of the image capturing lens system is f, the focal length of the fourth lens element is f4, and the following condition is satisfied: $-1.50 < f/f4 < -0.30$, the accuracy of peripheral focus position of an image can be increased, and it is favorable for correcting a curved image so that the image approximates the imaged subject.

When the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element and the sixth lens element are all made of plastic material, an axial distance between the object-side surface of the first lens element and the image surface is TL, and the following condition is satisfied: $TL < 8.0$ mm, the lens system's size can be controlled to keep the lens system compact.

According to the image capturing lens system of the present disclosure, the lens elements thereof can be made of glass or plastic material. When the lens elements are made of glass material, the distribution of the refractive power of the image capturing lens system may be more flexible to design. When the lens elements are made of plastic material, the manufacturing cost can be effectively reduced. Furthermore, surfaces of each lens element can be arranged to be aspheric (ASP). Since these aspheric surfaces can be easily formed into shapes other than spherical shapes so as to have more controllable variables for eliminating the aberration and to further decrease the required number of lens elements, the total track length of the image capturing lens system can be effectively reduced.

According to the image capturing lens system of the present disclosure, the image capturing lens system can include at least one stop, such as an aperture stop, a glare stop or a field stop, so as to favorably reduce the amount of stray light and thereby to improve the image quality.

According to the image capturing lens system of the present disclosure, a stop can be configured as a front stop or a middle stop. A front stop disposed between an imaged object and the first lens element can provide a longer distance between an exit pupil of the image capturing lens system and the image surface, thereby the generated telecentric effect improves the image-sensing efficiency of an image sensor, such as a CCD or CMOS sensor. A middle stop disposed between the first lens element and the image surface is favorable for enlarging the field of view of the image capturing lens system and thereby to provide a wider field of view for the same.

According to the image capturing lens system of the present disclosure, when the lens element has a convex surface and the region of convex shape is not defined, it indicates that the surface is convex in the paraxial region thereof; when the lens element has a concave surface and the region of concave shape is not defined, it indicates that the surface is concave in the paraxial region thereof. Likewise, when the region of refractive power or focal length of a lens element is not defined, it indicates that the region of refractive power or focal length of the lens element is in the paraxial region thereof.

According to the image capturing lens system of the present disclosure, an image surface of the image capturing

lens system, based on the corresponding image sensor, can be a plane or a curved surface with any curvature, especially a curved surface being concave facing towards the object side.

The image capturing lens system of the present disclosure can be optionally applied to moving focus optical systems. According to the image capturing lens system of the present disclosure, the image capturing lens system features good correction capability and high image quality, and can be applied to 3D (three-dimensional) image capturing applications and electronic devices, such as digital cameras, mobile devices, digital tablets, smart TV, network surveillance devices, motion sensing input devices, driving recording systems, rear view camera systems, and wearable devices.

According to the present disclosure, an image capturing apparatus includes the aforementioned image capturing lens system and an image sensor, wherein the image sensor is disposed on or near an image surface of the image capturing lens system. Therefore, the design of the image capturing lens system enables the image capturing apparatus to achieve the best image quality. Preferably, the image capturing lens system can further include a barrel member, a holding member or a combination thereof.

Referring to FIG. 10A, FIG. 10B and FIG. 10C, an image capturing apparatus 1001 may be installed in an electronic device including, but not limited to, a smart phone 1010, a tablet personal computer 1020 or a wearable device 1030. The three exemplary figures of different electronic devices are only exemplary for showing the image capturing apparatus of the present disclosure installed in an electronic device, and the present disclosure is not limited thereto. Preferably, the electronic device can further include a control unit, a display unit, a storage unit, a random access memory unit (RAM) or a combination thereof.

According to the above description of the present disclosure, the following 1st-9th specific embodiments are provided for further explanation.

1st Embodiment

FIG. 1A is a schematic view of an image capturing apparatus according to the 1st embodiment of the present disclosure. FIG. 1B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 1st embodiment.

In FIG. 1A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor 190. The image capturing lens system includes, in order from an object side to an image side, a first lens element 110, an aperture stop 100, a second lens element 120, a third lens element 130, a fourth lens element 140, a fifth lens element 150, a sixth lens element 160, an IR-cut filter 170 and an image surface 180, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element 110 with positive refractive power has an object-side surface 111 being convex in a paraxial region thereof and an image-side surface 112 being convex in a paraxial region thereof, which are both aspheric, and the first lens element 110 is made of plastic material.

The second lens element 120 with negative refractive power has an object-side surface 121 being convex in a paraxial region thereof and an image-side surface 122 being concave in a paraxial region thereof, which are both aspheric, and the second lens element 120 is made of plastic material.

The third lens element **130** with negative refractive power has an object-side surface **131** being convex in a paraxial region thereof and an image-side surface **132** being concave in a paraxial region thereof, which are both aspheric, and the third lens element **130** is made of plastic material.

The fourth lens element **140** with negative refractive power has an object-side surface **141** being convex in a paraxial region thereof and an image-side surface **142** being concave in a paraxial region thereof, which are both aspheric, and the fourth lens element **140** is made of plastic material.

The fifth lens element **150** with positive refractive power has an object-side surface **151** being convex in a paraxial region thereof and an image-side surface **152** being concave in a paraxial region thereof, which are both aspheric, and the fifth lens element **150** is made of plastic material.

The sixth lens element **160** with negative refractive power has an object-side surface **161** being concave in a paraxial region thereof and an image-side surface **162** being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element **160** is made of plastic material.

At least one of the first lens element **110**, the second lens element **120**, the third lens element **130**, the fourth lens element **140**, the fifth lens element **150**, and the sixth lens element **160** has at least one inflection point.

The IR-cut filter **170** is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor **190** is disposed on or near the image surface **180** of the image capturing lens system.

The equation of the aspheric surface profiles is expressed as follows:

$$X(Y) = (Y^2/R) / (1 + \sqrt{1 - (1+k) \cdot (Y/R)^2}) + \sum_i (A_i \cdot Y^i),$$

where,

X is the relative distance between a point on the aspheric surface spaced at a distance Y from the optical axis and the tangential plane at the aspheric surface vertex on the optical axis;

Y is the vertical distance from the point on the aspheric surface profile to the optical axis;

R is the curvature radius;

k is the conic coefficient; and

A_i is the i-th aspheric coefficient.

In the first embodiment, a focal length of the image capturing lens system is f, an f-number of the image capturing lens system is Fno, half of a maximal field of view of the image capturing lens system is HFOV, and these parameters have the following values: f=6.44 mm; Fno=3.00; and HFOV=23.0 degrees.

In the first embodiment, a maximum refractive index among the refractive indices of the first lens element **110**, the second lens element **120**, the third lens element **130**, the fourth lens element **140**, the fifth lens element **150**, and the sixth lens element **160** is Nmax, and the parameter has the following value: Nmax=1.639.

In the first embodiment, an Abbe number of the second lens element **120** is V2, an Abbe number of the third lens element **130** is V3, an Abbe number of the fifth lens element **150** is V5, an Abbe number of the fourth lens element **140** is V4, and they satisfy the condition: (V2+V3+V5)/V4=1.26.

In the first embodiment, a central thickness of the fourth lens element **140** is CT4, a central thickness of the fifth lens element **150** is CT5, and they satisfy the condition: CT4/CT5=0.96.

In the first embodiment, an axial distance between the fifth lens element **150** and the sixth lens element **160** is T56, the central thickness of the fifth lens element **150** is CT5, and they satisfy the condition: T56/CT5=3.84.

In the first embodiment, the focal length of the image capturing lens system is f, a curvature radius of the object-side surface **111** of the first lens element **110** is R1, and they satisfy the condition: f/R1=3.84.

In the first embodiment, a curvature radius of the image-side surface **122** of the second lens element **120** is R4, a curvature radius of the object-side surface **121** of the second lens element **120** is R3, and they satisfy the condition: R4/R3=0.06.

In the first embodiment, the focal length of the image capturing lens system is f, a curvature radius of the object-side surface **161** of the sixth lens element **160** is R11, a curvature radius of the image-side surface **162** of the sixth lens element **160** is R12, and they satisfy the condition: (f/R11)+(f/R12)=-3.37.

In the first embodiment, a focal length of the fourth lens element **140** is f4, a focal length of the third lens element **130** is f3, and they satisfy the condition: f4/f3=-0.07.

In the first embodiment, the focal length of the image capturing lens system is f, the focal length of the fourth lens element **140** is f4, and they satisfy the condition: f/f4=-0.73.

In the first embodiment, the axial distance between the fifth lens element **150** and the sixth lens element **160** is T56, a sum of axial air gaps between every two adjacent lens elements is ΣAT, and they satisfy the condition: T56/(ΣAT-T56)=1.94.

In the first embodiment, half of the maximal field of view of the image capturing lens system is HFOV, and it satisfies the condition: tan(2*HFOV)=1.03.

In the first embodiment, a distance in parallel with an optical axis from an intersection of the image-side surface **162** of the sixth lens element **160** and the optical axis to a maximum effective radius position on the image-side surface **162** of the sixth lens element **160** is SAG62, a central thickness of the sixth lens element **160** is CT6, and they satisfy the condition: SAG62/CT6=-2.03.

In the first embodiment, an axial distance between the aperture stop **100** and the image-side surface **162** of the sixth lens element **160** is SD, an axial distance between the object-side surface **111** of the first lens element **110** and the image-side surface **162** of the sixth lens element **160** is TD, and they satisfy the condition: SD/TD=0.85.

In the first embodiment, an axial distance between the image-side surface **162** of the sixth lens element **160** and the image surface **180** is BL, the axial distance between the object-side surface **111** of the first lens element **110** and the image-side surface **162** of the sixth lens element **160** is TD, and they satisfy the condition: BL/TD=0.18.

In the first embodiment, an axial distance between the object-side surface **111** of the first lens element **110** and the image surface **180** is TL, and the parameter has the following value: TL=6.08 mm.

TABLE 1

(Embodiment 1)								
f = 6.44 mm, Fno = 3.00, HFOV = 23.0 deg.								
Surface #		Curvature	Radius	Thickness	Material	Index	Abbe #	Focal Length
0	Object	Plano	Infinity					
1	Lens 1	1.679	ASP	0.753	Plastic	1.544	55.9	3.01
2		-59.361	ASP	0.012				
3	Ape. Stop	Plano		0.043				
4	Lens 2	60.100	ASP	0.286	Plastic	1.639	23.5	-6.43
5		3.840	ASP	0.263				
6	Lens 3	11.846	ASP	0.479	Plastic	1.639	23.5	-123.59
7		10.138	ASP	0.134				
8	Lens 4	23.471	ASP	0.388	Plastic	1.544	55.9	-8.76
9		3.939	ASP	0.352				
10	Lens 5	6.639	ASP	0.406	Plastic	1.639	23.5	17.98
11		15.355	ASP	1.559				
12	Lens 6	-2.708	ASP	0.488	Plastic	1.544	55.9	-8.94
13		-6.493	ASP	0.300				
14	IR-cut filter	Plano		0.210	Glass	1.517	64.2	—
15		Plano		0.411				
16	Image Surface	Plano		—				

*Reference Wavelength is d-line 587.6 nm

TABLE 2

Aspheric Coefficients						
Surface #	1	2	4	5	6	7
k =	-5.9905E+00	-9.0000E+01	2.3396E+01	7.8630E+00	-2.4799E+01	8.6927E+01
A4 =	1.4747E-01	-1.1657E-01	-1.5617E-01	-1.2885E-01	-1.2991E-01	-1.8543E-01
A6 =	-9.0801E-02	3.4557E-01	5.3312E-01	3.5786E-01	2.0201E-01	3.2571E-01
A8 =	6.4144E-02	-5.1313E-01	-7.6102E-01	-3.7793E-01	-1.9648E-02	-1.5259E-01
A10 =	-3.2126E-02	4.0320E-01	6.1470E-01	2.3337E-01	1.4381E-02	-6.2244E-02
A12 =	5.2415E-03	-1.6726E-01	-2.5561E-01	1.0249E-01	-1.2040E-03	2.3679E-01
A14 =	-4.9261E-04	2.8815E-02	4.2637E-02	-1.3265E-01	-2.1851E-02	-1.3582E-01
Surface #	8	9	10	11	12	13
k =	8.4052E+01	-7.9854E+00	-5.2127E+00	2.8673E+01	1.6311E-01	-1.5781E+01
A4 =	-2.0076E-01	-1.1710E-01	-1.6121E-01	-9.8368E-02	-1.0454E-01	-1.2563E-01
A6 =	4.8150E-01	4.0987E-01	1.7628E-01	9.3820E-02	1.0696E-01	9.0710E-02
A8 =	-5.5700E-01	-5.5591E-01	-9.5116E-02	-5.6034E-02	-6.1210E-02	-4.0510E-02
A10 =	2.7880E-01	4.0300E-01	2.6181E-02	3.3588E-02	1.9174E-02	9.7461E-03
A12 =	3.5831E-02	-1.5234E-01	-3.1053E-03	-1.5119E-02	-2.9574E-03	-1.1985E-03
A14 =	-5.0224E-02	2.5138E-02	-3.5228E-04	3.5280E-03	1.9326E-04	4.7340E-05
A16 =				-3.3686E-04	-2.4189E-06	2.2159E-06

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2nd Embodiment

FIG. 2A is a schematic view of an image capturing apparatus according to the 2nd embodiment of the present disclosure. FIG. 2B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 2nd embodiment.

In FIG. 2A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor 290. The image capturing lens system includes, in order from an object side to an image side, a first lens element 210, a second lens element 220, an aperture stop 200, a third lens element 230, a fourth lens element 240, a fifth lens element 250, a sixth lens element 260, an IR-cut filter 270 and an image surface 280, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element 210 with positive refractive power has an object-side surface 211 being convex in a paraxial region thereof and an image-side surface 212 being convex

in a paraxial region thereof, which are both aspheric, and the first lens element 210 is made of plastic material.

The second lens element 220 with negative refractive power has an object-side surface 221 being convex in a paraxial region thereof and an image-side surface 222 being concave in a paraxial region thereof, which are both aspheric, and the second lens element 220 is made of plastic material.

The third lens element 230 with positive refractive power has an object-side surface 231 being convex in a paraxial region thereof and an image-side surface 232 being convex in a paraxial region thereof, which are both aspheric, and the third lens element 230 is made of plastic material.

The fourth lens element 240 with negative refractive power has an object-side surface 241 being concave in a paraxial region thereof and an image-side surface 242 being convex in a paraxial region thereof, which are both aspheric, and the fourth lens element 240 is made of plastic material.

The fifth lens element 250 with positive refractive power has an object-side surface 251 being convex in a paraxial region thereof and an image-side surface 252 being concave

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in a paraxial region thereof, which are both aspheric, and the fifth lens element **250** is made of plastic material.

The sixth lens element **260** with negative refractive power has an object-side surface **261** being concave in a paraxial region thereof and an image-side surface **262** being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element **260** is made of plastic material.

At least one of the first lens element **210**, the second lens element **220**, the third lens element **230**, the fourth lens element **240**, the fifth lens element **250**, and the sixth lens element **260** has at least one inflection point.

The IR-cut filter **270** is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor **290** is disposed on or near the image surface **280** of the image capturing lens system.

The detailed optical data of the second embodiment are shown in TABLE 3, and the aspheric surface data are shown in TABLE 4, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 3

(Embodiment 2)						
f = 6.18 mm, Fno = 3.00, HFOV = 24.8 deg.						
Surface #		Curvature Radius	Thickness	Material	Index	Focal Length
0	Object	Plano	Infinity			
1	Lens 1	1.684	ASP	0.909	Plastic	1.544
2		-28.657	ASP	0.032		
3	Lens 2	64.812	ASP	0.230	Plastic	1.650
4		3.456	ASP	0.118		
5	Ape. Stop	Plano	0.206			
6	Lens 3	417.693	ASP	0.460	Plastic	1.650
7		-13.801	ASP	0.193		
8	Lens 4	-3.808	ASP	0.385	Plastic	1.535
9		-35.505	ASP	0.350		
10	Lens 5	4.183	ASP	0.340	Plastic	1.614
11		5.456	ASP	1.504		
12	Lens 6	-2.674	ASP	0.440	Plastic	1.535
13		-6.927	ASP	0.300		
14	IR-cut filter	Plano	0.210	Glass	1.517	64.2
15		Plano	0.266			
16	Image Surface	Plano	—			

*Reference wavelength is d-line 587.6 nm

TABLE 4

Aspheric Coefficients						
Surface #	1	2	3	4	6	7
k =	-5.9943E+00	-9.0000E+01	-8.8996E+01	8.0345E+00	-9.0000E+01	-4.3529E+01
A4 =	1.5145E-01	-1.1312E-01	-1.5699E-01	-1.2580E-01	-1.3534E-01	-1.9104E-01
A6 =	-9.3675E-02	3.4248E-01	5.3595E-01	3.5490E-01	2.0289E-01	3.2045E-01
A8 =	6.3668E-02	-5.1941E-01	-7.5985E-01	-3.7679E-01	-2.1876E-02	-1.5352E-01
A10 =	-2.7898E-02	4.0640E-01	6.1262E-01	2.3150E-01	1.3152E-02	-6.2343E-02
A12 =	3.9576E-03	-1.6201E-01	-2.6037E-01	9.7626E-02	-1.6879E-03	2.3727E-01
A14 =	-2.6528E-04	2.5828E-02	4.5528E-02	-1.3744E-01	-2.2607E-02	-1.3464E-01
Surface #	8	9	10	11	12	13
k =	-1.2959E+01	9.0000E+01	-1.5700E+01	-4.5303E+01	1.5424E-01	-1.3680E+01
A4 =	-1.9982E-01	-1.1381E-01	-1.9679E-01	-1.2469E-01	-1.0845E-01	-1.2308E-01
A6 =	4.8260E-01	4.1034E-01	1.7804E-01	9.4998E-02	1.0688E-01	9.0671E-02
A8 =	-5.5778E-01	-5.5611E-01	-9.3912E-02	-5.5372E-02	-6.1194E-02	-4.0523E-02
A10 =	2.7871E-01	4.0286E-01	2.6458E-02	3.3669E-02	1.9178E-02	9.7491E-03
A12 =	3.5480E-02	-1.5224E-01	-3.1006E-03	-1.5099E-02	-2.9566E-03	-1.1980E-03
A14 =	-5.1310E-02	2.5350E-02	-3.8691E-04	3.5313E-03	1.9342E-04	4.7253E-05
A16 =				-3.3755E-04	-2.3921E-06	2.1772E-06

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In the 2nd embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 5 below are the same as those stated in the 1st embodiment with corresponding values for the 2nd embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 3 and Table 4 and satisfy the conditions stated in Table 5.

TABLE 5

2 nd Embodiment			
f [mm]	6.18	(f/R11) + (f/R12)	-3.20
Fno	3.00	f4/ f3	-0.39
HFOV [deg.]	24.8	f/f4	-0.77
Nmax	1.650	T56/(ΣAT - T56)	1.67
(V2 + V3 + V5)/V4	1.23	tan(2 * HFOV)	1.18
CT4/CT5	1.13	SAG62/CT6	-2.26
T56/CT5	4.42	SD/TD	0.75

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TABLE 5-continued

2 nd Embodiment			
f/R1	3.67	BL/TD	0.15
R4/R3	0.05	TL [mm]	5.94

3rd Embodiment

FIG. 3A is a schematic view of an image capturing apparatus according to the 3rd embodiment of the present disclosure. FIG. 3B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 3rd embodiment.

In FIG. 3A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor **390**. The image capturing lens system includes, in order from an object side to an image side, an aperture stop **300**, a first lens element **310**, a second lens element **320**, a third lens element **330**, a fourth lens element **340**, a fifth lens element **350**, a sixth lens element **360**, an IR-cut filter **370** and an image surface **380**, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element **310** with positive refractive power has an object-side surface **311** being convex in a paraxial region thereof and an image-side surface **312** being concave in a paraxial region thereof, which are both aspheric, and the first lens element **310** is made of plastic material.

The second lens element **320** with negative refractive power has an object-side surface **321** being convex in a paraxial region thereof and an image-side surface **322** being concave in a paraxial region thereof, which are both aspheric, and the second lens element **320** is made of plastic material.

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The third lens element **330** with positive refractive power has an object-side surface **331** being convex in a paraxial region thereof and an image-side surface **332** being concave in a paraxial region thereof, which are both aspheric, and the third lens element **330** is made of plastic material.

The fourth lens element **340** with negative refractive power has an object-side surface **341** being concave in a paraxial region thereof and an image-side surface **342** being concave in a paraxial region thereof, which are both aspheric, and the fourth lens element **340** is made of plastic material.

The fifth lens element **350** with positive refractive power has an object-side surface **351** being convex in a paraxial region thereof and an image-side surface **352** being concave in a paraxial region thereof, which are both aspheric, and the fifth lens element **350** is made of plastic material.

The sixth lens element **360** with negative refractive power has an object-side surface **361** being concave in a paraxial region thereof and an image-side surface **362** being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element **360** is made of plastic material.

At least one of the first lens element **310**, the second lens element **320**, the third lens element **330**, the fourth lens element **340**, the fifth lens element **350**, and the sixth lens element **360** has at least one inflection point.

The IR-cut filter **370** is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor **390** is disposed on or near the image surface **380** of the image capturing lens system.

The detailed optical data of the third embodiment are shown in TABLE 6, and the aspheric surface data are shown in TABLE 7, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 6

(Embodiment 3)								
f = 6.32 mm, Fno = 2.95, HFOV = 24.3 deg.								
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length	
0	Object	Plano	Infinity					
1	Ape. Stop	Plano	-0.374					
2	Lens 1	1.666 ASP	0.678	Plastic	1.544	55.9	3.10	
3		128.006 ASP	0.058					
4	Lens 2	18.721 ASP	0.330	Plastic	1.650	21.4	-5.83	
5		3.127 ASP	0.297					
6	Lens 3	10.989 ASP	0.512	Plastic	1.650	21.4	22.27	
7		44.874 ASP	0.137					
8	Lens 4	-55.952 ASP	0.305	Plastic	1.535	55.7	-10.02	
9		5.939 ASP	0.350					
10	Lens 5	10.073 ASP	0.473	Plastic	1.614	25.6	50.53	
11		14.648 ASP	1.572					
12	Lens 6	-2.650 ASP	0.483	Plastic	1.535	55.7	-8.89	
13		-6.360 ASP	0.300					
14	IR-cut filter	Plano	0.210	Glass	1.517	64.2	—	
15		Plano	0.297					
16	Image Surface	Plano	—					

* Reference wavelength is d-line 587.6 nm

TABLE 7

Aspheric Coefficients						
Surface #	2	3	4	5	6	7
k =	-5.8926E+00	-9.0000E+01	9.9788E+00	7.7802E+00	8.9282E+01	9.0000E+01
A4 =	1.5513E-01	-1.0983E-01	-1.6760E-01	-1.5920E-01	-1.4218E-01	-1.9047E-01

TABLE 7-continued

Aspheric Coefficients						
A6 =	-9.2786E-02	3.5001E-01	5.2862E-01	3.5611E-01	2.0120E-01	3.1830E-01
A8 =	6.4811E-02	-5.1777E-01	-7.5912E-01	-3.7882E-01	-2.2099E-02	-1.5281E-01
A10 =	-2.7874E-02	3.9711E-01	6.1176E-01	2.2541E-01	1.6488E-02	-6.0484E-02
A12 =	4.1702E-03	-1.5903E-01	-2.6306E-01	8.7241E-02	-2.1009E-03	2.4016E-01
A14 =	-7.4284E-04	2.5610E-02	4.5981E-02	-1.4784E-01	-2.2128E-02	-1.3103E-01
Surface #	8	9	10	11	12	13
k =	9.0000E+01	-4.5413E+01	6.1259E+01	7.3183E+01	1.5394E-01	-4.9420E+00
A4 =	-1.9565E-01	-1.1113E-01	-2.1663E-01	-1.2277E-01	-1.0998E-01	-1.2545E-01
A6 =	4.8597E-01	4.1151E-01	1.7081E-01	9.0472E-02	1.0696E-01	9.0335E-02
A8 =	-5.5848E-01	-5.5621E-01	-9.1516E-02	-5.5362E-02	-6.1176E-02	-4.0521E-02
A10 =	2.7710E-01	4.0238E-01	2.5964E-02	3.3813E-02	1.9180E-02	9.7552E-03
A12 =	3.2610E-02	-1.5222E-01	-4.0975E-03	-1.5061E-02	-2.9561E-03	-1.1967E-03
A14 =	-5.5172E-02	2.5697E-02	-1.2688E-03	3.5288E-03	1.9352E-04	4.7395E-05
A16 =				-3.4536E-04	-2.3804E-06	2.1813E-06

In the 3rd embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 8 below are the same as those stated in the 1st embodiment with corresponding values for the 3rd embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 6 and Table 7 and satisfy the conditions stated in Table 8.

TABLE 8

3 rd Embodiment			
f [mm]	6.32	(f/R11) + (f/R12)	-3.38
Fno	2.95	f4/ f3	-0.45
HFOV [deg.]	24.3	f/f4	-0.63
Nmax	1.650	T56/(ΣAT - T56)	1.87
(V2 + V3 + V5)/V4	1.23	tan(2 * HFOV)	1.13
CT4/CT5	0.64	SAG62/CT6	-2.37
T56/CT5	3.32	SD/TD	0.93
f/R1	3.80	BL/TD	0.16
R4/R3	0.17	TL [mm]	6.00

4th Embodiment

FIG. 4A is a schematic view of an image capturing apparatus according to the 4th embodiment of the present disclosure. FIG. 4B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 4th embodiment.

In FIG. 4A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor 490. The image capturing lens system includes, in order from an object side to an image side, an aperture stop 400, a first lens element 410, a second lens element 420, a third lens element 430, a fourth lens element 440, a fifth lens element 450, a sixth lens element 460, an IR-cut filter 470 and an image surface 480, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element 410 with positive refractive power has an object-side surface 411 being convex in a paraxial region thereof and an image-side surface 412 being convex in a paraxial region thereof, which are both aspheric, and the first lens element 410 is made of plastic material.

The second lens element 420 with negative refractive power has an object-side surface 421 being convex in a paraxial region thereof and an image-side surface 422 being concave in a paraxial region thereof, which are both aspheric, and the second lens element 420 is made of plastic material.

The third lens element 430 with positive refractive power has an object-side surface 431 being convex in a paraxial region thereof and an image-side surface 432 being concave in a paraxial region thereof, which are both aspheric, and the third lens element 430 is made of plastic material.

The fourth lens element 440 with negative refractive power has an object-side surface 441 being concave in a paraxial region thereof and an image-side surface 442 being concave in a paraxial region thereof, which are both aspheric, and the fourth lens element 440 is made of plastic material.

The fifth lens element 450 with positive refractive power has an object-side surface 451 being convex in a paraxial region thereof and an image-side surface 452 being concave in a paraxial region thereof, which are both aspheric, and the fifth lens element 450 is made of plastic material.

The sixth lens element 460 with positive refractive power has an object-side surface 461 being concave in a paraxial region thereof and an image-side surface 462 being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element 460 is made of plastic material.

At least one of the first lens element 410, the second lens element 420, the third lens element 430, the fourth lens element 440, the fifth lens element 450, and the sixth lens element 460 has at least one inflection point.

The IR-cut filter 470 is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor 490 is disposed on or near the image surface 480 of the image capturing lens system.

The detailed optical data of the fourth embodiment are shown in TABLE 9, and the aspheric surface data are shown in TABLE 10, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 9

(Embodiment 4)							
f = 6.32 mm, Fno = 2.90, HFOV = 22.7 deg.							
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length
0	Object	Plano	Infinity				
1	Ape. Stop	Plano	-0.384				
2	Lens 1	1.664	ASP	0.788	Plastic	1.544	55.9
3		-29.631	ASP	0.041			2.92
4	Lens 2	90.412	ASP	0.328	Plastic	1.634	23.8
5		3.137	ASP	0.280			-5.13
6	Lens 3	11.756	ASP	0.718	Plastic	1.640	23.3
7		21.818	ASP	0.171			38.76
8	Lens 4	-22.412	ASP	0.413	Plastic	1.535	55.7
9		6.057	ASP	0.350			-8.87
10	Lens 5	10.549	ASP	0.882	Plastic	1.535	55.7
11		10.513	ASP	1.279			762.09
12	Lens 6	-2.238	ASP	0.505	Plastic	1.535	55.7
13		-1.885	ASP	0.200			14.92
14	IR-cut filter	Plano	0.210	Glass	1.517	64.2	—
15		Plano	0.208				
16	Image Surface	Plano	—				

* Reference wavelength is d-line 587.6 nm

TABLE 10

Aspheric Coefficients						
Surface #	2	3	4	5	6	7
k =	-5.8765E+00	9.0000E+01	9.0000E+01	7.7467E+00	9.0000E+01	8.5616E+01
A4 =	1.5359E-01	-1.0717E-01	-1.5991E-01	-1.7429E-01	-1.5578E-01	-1.7089E-01
A6 =	-9.4281E-02	3.5098E-01	5.2872E-01	3.5819E-01	1.9886E-01	3.2396E-01
A8 =	6.5022E-02	-5.1783E-01	-7.6020E-01	-3.7535E-01	-2.1567E-02	-1.5060E-01
A10 =	-2.7141E-02	3.9668E-01	6.1101E-01	2.2691E-01	1.6967E-02	-6.0022E-02
A12 =	4.5957E-03	-1.5932E-01	-2.6370E-01	8.8617E-02	-2.1662E-03	2.4063E-01
A14 =	-7.1283E-04	2.5414E-02	4.5447E-02	-1.4623E-01	-2.2241E-02	-1.3027E-01
Surface #	8	9	10	11	12	13
k =	6.7513E+01	-4.7021E+01	3.9300E+01	3.2532E+01	1.0545E-01	-7.0916E+00
A4 =	-1.9152E-01	-1.3449E-01	-2.3191E-01	-1.2605E-01	-8.5414E-02	-1.2063E-01
A6 =	4.8989E-01	4.0293E-01	1.6480E-01	7.7041E-02	1.0368E-01	8.8047E-02
A8 =	-5.5655E-01	-5.6136E-01	-9.7465E-02	-5.5345E-02	-6.0809E-02	-4.0860E-02
A10 =	2.7948E-01	3.9916E-01	2.1709E-02	3.4856E-02	1.9119E-02	9.7503E-03
A12 =	3.3097E-02	-1.5391E-01	-5.1987E-03	-1.4945E-02	-2.9718E-03	-1.1899E-03
A14 =	-5.6130E-02	2.4890E-02	-1.2042E-03	3.5269E-03	1.9303E-04	4.9329E-05
A16 =				-3.5478E-04	-1.7086E-06	2.5661E-06

In the 4th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 11 below are the same as those stated in the 1st embodiment with corresponding values for the 4th embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 9 and Table 10 and satisfy the conditions stated in Table 11.

TABLE 11

4 th Embodiment			
f [mm]	6.32	(f/R11) + (f/R12)	-6.18
Fno	2.90	f4/f3	-0.23
HFOV [deg.]	22.7	f/4	-0.71
Nmax	1.640	T56/(ΣAT - T56)	1.52
(V2 + V3 + V5)/V4	1.85	tan(2 * HFOV)	1.01
CT4/CT5	0.47	SAG62/CT6	-2.66
T56/CT5	1.45	SD/TD	0.93

TABLE 11-continued

4 th Embodiment			
f/R1	3.80	BL/TD	0.11
R4/R3	0.03	TL [mm]	6.37

5th Embodiment

FIG. 5A is a schematic view of an image capturing apparatus according to the 5th embodiment of the present disclosure. FIG. 5B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 5th embodiment.

In FIG. 5A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor 590. The image capturing lens system includes, in order from an object side to an image side, an aperture stop 500, a first lens

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element **510**, a second lens element **520**, a third lens element **530**, a fourth lens element **540**, a fifth lens element **550**, a sixth lens element **560**, an IR-cut filter **570** and an image surface **580**, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element **510** with positive refractive power has an object-side surface **511** being convex in a paraxial region thereof and an image-side surface **512** being convex in a paraxial region thereof, which are both aspheric, and the first lens element **510** is made of plastic material.

The second lens element **520** with negative refractive power has an object-side surface **521** being concave in a paraxial region thereof and an image-side surface **522** being concave in a paraxial region thereof, which are both aspheric, and the second lens element **520** is made of plastic material.

The third lens element **530** with positive refractive power has an object-side surface **531** being convex in a paraxial region thereof and an image-side surface **532** being concave in a paraxial region thereof, which are both aspheric, and the third lens element **530** is made of plastic material.

The fourth lens element **540** with negative refractive power has an object-side surface **541** being concave in a paraxial region thereof and an image-side surface **542** being

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concave in a paraxial region thereof, which are both aspheric, and the fourth lens element **540** is made of plastic material.

The fifth lens element **550** with negative refractive power has an object-side surface **551** being concave in a paraxial region thereof and an image-side surface **552** being convex in a paraxial region thereof, which are both aspheric, and the fifth lens element **550** is made of plastic material.

The sixth lens element **560** with positive refractive power has an object-side surface **561** being concave in a paraxial region thereof and an image-side surface **562** being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element **560** is made of plastic material.

At least one of the first lens element **510**, the second lens element **520**, the third lens element **530**, the fourth lens element **540**, the fifth lens element **550**, and the sixth lens element **560** has at least one inflection point.

The IR-cut filter **570** is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor **590** is disposed on or near the image surface **580** of the image capturing lens system.

The detailed optical data of the fifth embodiment are shown in TABLE 12, and the aspheric surface data are shown in TABLE 13, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 12

(Embodiment 5)								
f = 6.40 mm, Fno = 2.90, HFOV = 22.3 deg.								
Surface #		Curvature	Radius	Thickness	Material	Index	Abbe #	Focal Length
0	Object	Plano		Infinity				
1	Ape. Stop	Plano		-0.399				
2	Lens 1	1.663	ASP	0.858	Plastic	1.544	55.9	2.87
3		-20.891	ASP	0.038				
4	Lens 2	-286.093	ASP	0.330	Plastic	1.634	23.8	-4.91
5		3.146	ASP	0.258				
6	Lens 3	11.876	ASP	0.684	Plastic	1.640	23.3	30.93
7		29.035	ASP	0.175				
8	Lens 4	-8.061	ASP	0.363	Plastic	1.535	55.7	-11.43
9		25.750	ASP	0.340				
10	Lens 5	-20.080	ASP	0.888	Plastic	1.535	55.7	-50.04
11		-81.566	ASP	1.295				
12	Lens 6	-2.191	ASP	0.574	Plastic	1.535	55.7	19.78
13		-1.981	ASP	0.200				
14	IR-cut filter	Plano		0.210	Glass	1.517	64.2	—
15		Plano		0.211				
16	Image Surface	Plano		—				

* Reference wavelength is d-line 587.6 nm

TABLE 13

Aspheric Coefficients						
Surface #	2	3	4	5	6	7
k =	-5.9045E+00	-4.4218E+01	-9.0000E+01	7.7142E+00	9.0000E+01	4.4987E+01
A4 =	1.5460E-01	-1.0747E-01	-1.5866E-01	-1.7228E-01	-1.5535E-01	-1.6783E-01
A6 =	-9.4454E-02	3.5106E-01	5.2869E-01	3.6196E-01	2.0296E-01	3.2392E-01
A8 =	6.4904E-02	-5.1795E-01	-7.6010E-01	-3.7230E-01	-2.1467E-02	-1.4857E-01
A10 =	-2.7069E-02	3.9677E-01	6.1085E-01	2.2842E-01	1.7138E-02	-5.8141E-02
A12 =	4.7009E-03	-1.5932E-01	-2.6379E-01	8.9464E-02	-1.8339E-03	2.4198E-01
A14 =	-6.3844E-04	2.5324E-02	4.5452E-02	-1.4580E-01	-2.1839E-02	-1.2917E-01
Surface #	8	9	10	11	12	13
k =	-1.7079E+01	7.8141E+01	-9.0000E+01	-9.0000E+01	9.4284E-02	-8.8964E+00
A4 =	-1.8348E-01	-1.3526E-01	-2.1676E-01	-1.1288E-01	-8.6239E-02	-1.2045E-01
A6 =	4.9498E-01	4.0617E-01	1.6920E-01	7.7021E-02	1.0171E-01	8.7791E-02
A8 =	-5.5496E-01	-5.6188E-01	-1.0106E-01	-5.5088E-02	-6.0652E-02	-4.0871E-02

TABLE 13-continued

Aspheric Coefficients						
A10 =	2.8088E-01	3.9907E-01	2.1522E-02	3.4946E-02	1.9136E-02	9.7521E-03
A12 =	3.4737E-02	-1.5382E-01	-5.0748E-03	-1.4933E-02	-2.9651E-03	-1.1901E-03
A14 =	-5.4281E-02	2.4929E-02	-6.6389E-04	3.5282E-03	1.9584E-04	4.9101E-05
A16 =				-3.5410E-04	-8.1719E-07	2.4935E-06

In the 5th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 14 below are the same as those stated in the 1st embodiment with corresponding values for the 5th embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 12 and Table 13 and satisfy the conditions stated in Table 14.

TABLE 14

Embodiment 5			
f [mm]	6.40	(f/R11) + (f/R12)	-6.16
Fno	2.90	f4/f3	-0.37
HFOV [deg.]	22.3	f/f4	-0.56
Nmax	1.640	T56/(ΣAT - T56)	1.60
(V2 + V3 + V5)/V4	1.85	tan(2 * HFOV)	0.99
CT4/CT5	0.41	SAG62/CT6	-2.35
T56/CT5	1.46	SD/TD	0.93
f/R1	3.85	BL/TD	0.11
R4/R3	-0.01	TL [mm]	6.42

6th Embodiment

FIG. 6A is a schematic view of an image capturing apparatus according to the 6th embodiment of the present disclosure. FIG. 6B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 6th embodiment.

In FIG. 6A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor 690. The image capturing lens system includes, in order from an object side to an image side, an aperture stop 600, a first lens element 610, a second lens element 620, a third lens element 630, a fourth lens element 640, a fifth lens element 650, a sixth lens element 660, an IR-cut filter 670 and an image surface 680, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element 610 with positive refractive power has an object-side surface 611 being convex in a paraxial region thereof and an image-side surface 612 being convex

in a paraxial region thereof, which are both aspheric, and the first lens element 610 is made of plastic material.

The second lens element 620 with negative refractive power has an object-side surface 621 being concave in a paraxial region thereof and an image-side surface 622 being concave in a paraxial region thereof, which are both aspheric, and the second lens element 620 is made of plastic material.

The third lens element 630 with positive refractive power has an object-side surface 631 being concave in a paraxial region thereof and an image-side surface 632 being convex in a paraxial region thereof, which are both aspheric, and the third lens element 630 is made of plastic material.

The fourth lens element 640 with negative refractive power has an object-side surface 641 being concave in a paraxial region thereof and an image-side surface 642 being concave in a paraxial region thereof, which are both aspheric, and the fourth lens element 640 is made of plastic material.

The fifth lens element 650 with negative refractive power has an object-side surface 651 being convex in a paraxial region thereof and an image-side surface 652 being concave in a paraxial region thereof, which are both aspheric, and the fifth lens element 650 is made of plastic material.

The sixth lens element 660 with negative refractive power has an object-side surface 661 being concave in a paraxial region thereof and an image-side surface 662 being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element 660 is made of plastic material.

At least one of the first lens element 610, the second lens element 620, the third lens element 630, the fourth lens element 640, the fifth lens element 650, and the sixth lens element 660 has at least one inflection point.

The IR-cut filter 670 is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor 690 is disposed on or near the image surface 680 of the image capturing lens system.

The detailed optical data of the sixth embodiment are shown in TABLE 15, and the aspheric surface data are shown in TABLE 16, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 15

(Embodiment 6)								
f = 6.64 mm, Fno = 2.65, HFOV = 19.3 deg.								
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length	
0	Object	Plano	Infinity					
1	Ape. Stop	Plano	-0.565					
2	Lens 1	1.645 ASP	0.959	Plastic	1.544	55.9	2.80	
3		-16.378 ASP	0.050					
4	Lens 2	-327.261 ASP	0.312	Plastic	1.640	23.3	-5.21	
5		3.367 ASP	0.342					
6	Lens 3	-20.548 ASP	0.688	Plastic	1.640	23.3	41.92	

TABLE 15-continued

(Embodiment 6)								
f = 6.64 mm, Fno = 2.65, HFOV = 19.3 deg.								
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length	
7		-11.786	ASP	0.192				
8	Lens 4	-4.629	ASP	0.369	Plastic	1.535	55.7	-6.87
9		18.302	ASP	0.305				
10	Lens 5	14.846	ASP	0.889	Plastic	1.583	30.2	-107.51
11		11.740	ASP	0.905				
12	Lens 6	-5.890	ASP	0.655	Plastic	1.535	55.7	-34.28
13		-9.012	ASP	0.300				
14	IR-cut filter	Plano	0.210	Glass	1.517	64.2	—	
15		Plano	0.343					
16	Image Surface	Plano	—					

* Reference wavelength is d-line 587.6 nm

TABLE 16

Aspheric Coefficients						
Surface #	2	3	4	5	6	7
k =	-6.0856E+00	-6.3201E+01	9.0000E+01	8.3036E+00	-3.5874E-01	7.2581E+01
A4 =	1.6354E-01	-1.0258E-01	-1.5336E-01	-1.2820E-01	-1.3432E-01	-2.1663E-01
A6 =	-9.5112E-02	3.5370E-01	5.3225E-01	3.4697E-01	1.9922E-01	3.3638E-01
A8 =	6.4810E-02	-5.1555E-01	-7.5979E-01	-3.6554E-01	-2.5834E-02	-1.4447E-01
A10 =	-2.6287E-02	3.9813E-01	6.1084E-01	2.3945E-01	2.0638E-02	-6.8415E-02
A12 =	5.4449E-03	-1.5873E-01	-2.6359E-01	9.9876E-02	2.2134E-03	2.3280E-01
A14 =	-2.1812E-04	2.5505E-02	4.5761E-02	-1.3693E-01	-2.0233E-02	-1.3067E-01
Surface #	8	9	10	11	12	13
k =	1.6923E+01	9.0000E+01	9.0000E+01	-1.5797E+00	3.8645E+00	-2.1027E+01
A4 =	-2.9040E-01	-2.1927E-01	-2.1458E-01	-1.0822E-01	-1.1101E-01	-1.2081E-01
A6 =	5.9010E-01	4.0595E-01	1.3552E-01	7.3259E-02	1.0273E-01	8.8386E-02
A8 =	-6.0034E-01	-5.4914E-01	-1.0528E-01	-5.5572E-02	-6.0834E-02	-4.0606E-02
A10 =	3.0872E-01	4.0317E-01	2.9096E-02	3.4915E-02	1.9007E-02	9.7617E-03
A12 =	5.3265E-02	-1.5230E-01	-8.9000E-04	-1.4939E-02	-3.0031E-03	-1.1948E-03
A14 =	-7.3259E-02	2.5999E-02	4.6334E-04	3.5209E-03	1.8567E-04	4.9003E-05
A16 =				-3.6027E-04	-3.1018E-06	2.9172E-06

In the 6th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 17 below are the same as those stated in the 1st embodiment with corresponding values for the 6th embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 15 and Table 16 and satisfy the conditions stated in Table 17.

TABLE 17

6 th Embodiment			
f [mm]	6.64	(f/R11) + (f/R12)	-1.86
Fno	2.65	f4/ f3	-0.16
HFOV [deg.]	19.3	f/f4	-0.97
Nmax	1.640	T56/(ΣAT - T56)	1.02
(V2 + V3 + V5)/V4	1.38	tan(2 * HFOV)	0.80
CT4/CT5	0.42	SAG62/CT6	-1.10
T56/CT5	1.02	SD/TD	0.90
f/R1	4.04	BL/TD	0.15
R4/R3	-0.01	TL [mm]	6.52

7th Embodiment

FIG. 7A is a schematic view of an image capturing apparatus according to the 7th embodiment of the present

disclosure. FIG. 7B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 7th embodiment.

In FIG. 7A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor 790. The image capturing lens system includes, in order from an object side to an image side, a first lens element 710, a second lens element 720, an aperture stop 700, a third lens element 730, a fourth lens element 740, a fifth lens element 750, a sixth lens element 760, an IR-cut filter 770 and an image surface 780, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element 710 with positive refractive power has an object-side surface 711 being convex in a paraxial region thereof and an image-side surface 712 being concave in a paraxial region thereof, which are both aspheric, and the first lens element 710 is made of plastic material.

The second lens element 720 with negative refractive power has an object-side surface 721 being convex in a paraxial region thereof and an image-side surface 722 being concave in a paraxial region thereof, which are both aspheric, and the second lens element 720 is made of plastic material.

The third lens element 730 with negative refractive power has an object-side surface 731 being convex in a paraxial

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region thereof and an image-side surface **732** being concave in a paraxial region thereof, which are both aspheric, and the third lens element **730** is made of plastic material.

The fourth lens element **740** with negative refractive power has an object-side surface **741** being concave in a paraxial region thereof and an image-side surface **742** being concave in a paraxial region thereof, which are both aspheric, and the fourth lens element **740** is made of plastic material.

The fifth lens element **750** with positive refractive power has an object-side surface **751** being convex in a paraxial region thereof and an image-side surface **752** being concave

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element **740**, the fifth lens element **750**, and the sixth lens element **760** has at least one inflection point.

The IR-cut filter **770** is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor **790** is disposed on or near the image surface **780** of the image capturing lens system.

The detailed optical data of the seventh embodiment are shown in TABLE 18, and the aspheric surface data are shown in TABLE 19, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 18

(Embodiment 7)								
f = 5.92 mm, Fno = 2.70, HFOV = 25.7 deg								
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length	
0	Object	Plano	Infinity					
1	Lens 1	1.678 ASP	0.923	Plastic	1.544	55.9	3.15	
2		60.373 ASP	0.020					
3	Lens 2	17.500 ASP	0.230	Plastic	1.650	21.4	-7.02	
4		3.599 ASP	0.151					
5	Ape. Stop	Plano	0.108					
6	Lens 3	10.602 ASP	0.509	Plastic	1.650	21.4	-1105.18	
7		10.250 ASP	0.156					
8	Lens 4	-9.580 ASP	0.358	Plastic	1.544	55.9	-10.18	
9		13.294 ASP	0.322					
10	Lens 5	4.350 ASP	0.328	Plastic	1.639	23.5	16.45	
11		7.201 ASP	1.552					
12	Lens 6	-2.683 ASP	0.439	Plastic	1.535	55.7	-7.74	
13		-8.057 ASP	0.200					
14	IR-cut filter	Plano	0.210	Glass	1.517	64.2	—	
15		Plano	0.281					
16	Image Surface	Plano	—					

* Reference wavelength is d-line 587.6 nm

TABLE 19

Aspheric Coefficients							
Surface #	1	2	3	4	6	7	
k =	-6.0017E+00	-2.5214E+01	8.8296E+01	7.9430E+00	-7.4486E+01	8.5444E+01	
A4 =	1.5289E-01	-1.1422E-01	-1.5622E-01	-1.3370E-01	-1.3215E-01	-1.9751E-01	
A6 =	-9.5741E-02	3.4446E-01	5.3177E-01	3.5730E-01	2.0105E-01	3.1936E-01	
A8 =	6.3085E-02	-5.2642E-01	-7.6160E-01	-3.7104E-01	-2.4703E-02	-1.5359E-01	
A10 =	-2.3209E-02	4.1068E-01	6.1589E-01	2.3613E-01	1.1372E-02	-6.1386E-02	
A12 =	-1.9663E-04	-1.5993E-01	-2.5519E-01	9.7561E-02	-1.9883E-03	2.3690E-01	
A14 =	1.3046E-03	2.4861E-02	4.0175E-02	-1.4707E-01	-2.1109E-02	-1.3530E-01	
Surface #	8	9	10	11	12	13	
k =	-8.4656E+01	-1.7966E+01	-6.2768E+00	-4.5916E+00	1.4708E-01	-6.8796E+00	
A4 =	-1.9802E-01	-1.1518E-01	-1.8892E-01	-1.2739E-01	-1.0821E-01	-1.2476E-01	
A6 =	4.8022E-01	4.1081E-01	1.7371E-01	9.3786E-02	1.0694E-01	9.0623E-02	
A8 =	-5.5720E-01	-5.5767E-01	-9.3445E-02	-5.5451E-02	-6.1190E-02	-4.0519E-02	
A10 =	2.7995E-01	4.0188E-01	2.6532E-02	3.3766E-02	1.9177E-02	9.7488E-03	
A12 =	3.6540E-02	-1.5265E-01	-3.0836E-03	-1.5100E-02	-2.9566E-03	-1.1970E-03	
A14 =	-5.0443E-02	2.5176E-02	-3.8116E-04	3.5301E-03	1.9341E-04	4.7192E-05	
A16 =				-3.3843E-04	-2.3956E-06	2.1709E-06	

in a paraxial region thereof, which are both aspheric, and the fifth lens element **750** is made of plastic material.

The sixth lens element **760** with negative refractive power has an object-side surface **761** being concave in a paraxial region thereof and an image-side surface **762** being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element **760** is made of plastic material.

At least one of the first lens element **710**, the second lens element **720**, the third lens element **730**, the fourth lens

In the 7th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 20 below are the same as those stated in the 1st embodiment with corresponding values for the 7th embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 18 and Table 19 and satisfy the conditions stated in Table 20.

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TABLE 20

7 th Embodiment			
f [mm]	5.92	(f/R11) + (f/R12)	-2.94
Fno	2.70	f4/ f3	-0.01
HFOV [deg.]	25.7	f/f4	-0.58
Nmax	1.650	T56/(ΣAT - T56)	2.05
(V2 + V3 + V5)/V4	1.18	tan(2 * HFOV)	1.25
CT4/CT5	1.09	SAG62/CT6	-2.43
T56/CT5	4.73	SD/TD	0.74
f/R1	3.53	BL/TD	0.14
R4/R3	0.21	TL [mm]	5.79

8th Embodiment

FIG. 8A is a schematic view of an image capturing apparatus according to the 8th embodiment of the present disclosure. FIG. 8B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 8th embodiment.

In FIG. 8A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor **890**. The image capturing lens system includes, in order from an object side to an image side, a first lens element **810**, an aperture stop **800**, a second lens element **820**, a third lens element **830**, a fourth lens element **840**, a fifth lens element **850**, a sixth lens element **860**, a stop **801**, an IR-cut filter **870** and an image surface **880**, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element **810** with positive refractive power has an object-side surface **811** being convex in a paraxial region thereof and an image-side surface **812** being convex in a paraxial region thereof, which are both aspheric, and the first lens element **810** is made of plastic material.

The second lens element **820** with negative refractive power has an object-side surface **821** being concave in a

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paraxial region thereof and an image-side surface **822** being concave in a paraxial region thereof, which are both aspheric, and the second lens element **820** is made of plastic material.

The third lens element **830** with positive refractive power has an object-side surface **831** being convex in a paraxial region thereof and an image-side surface **832** being concave in a paraxial region thereof, which are both aspheric, and the third lens element **830** is made of plastic material.

The fourth lens element **840** with negative refractive power has an object-side surface **841** being concave in a paraxial region thereof and an image-side surface **842** being concave in a paraxial region thereof, which are both aspheric, and the fourth lens element **840** is made of plastic material.

The fifth lens element **850** with positive refractive power has an object-side surface **851** being convex in a paraxial region thereof and an image-side surface **852** being concave in a paraxial region thereof, which are both aspheric, and the fifth lens element **850** is made of plastic material.

The sixth lens element **860** with negative refractive power has an object-side surface **861** being concave in a paraxial region thereof and an image-side surface **862** being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element **860** is made of plastic material.

At least one of the first lens element **810**, the second lens element **820**, the third lens element **830**, the fourth lens element **840**, the fifth lens element **850**, and the sixth lens element **860** has at least one inflection point.

The IR-cut filter **870** is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor **890** is disposed on or near the image surface **880** of the image capturing lens system.

The detailed optical data of the eighth embodiment are shown in TABLE 21, and the aspheric surface data are shown in TABLE 22, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 21

(Embodiment 8)								
f = 6.83 mm, Fno = 2.82, HFOV = 23.0 deg.								
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length	
0	Object	Plano	Infinity					
1	Lens 1	1.677 ASP	0.887	Plastic	1.544	55.9	2.86	
2		-17.543 ASP	-0.087					
3	Ape. Stop	Plano	0.137					
4	Lens 2	-47.245 ASP	0.300	Plastic	1.639	23.5	-4.56	
5		3.114 ASP	0.335					
6	Lens 3	7.035 ASP	0.402	Plastic	1.639	23.5	31.92	
7		10.501 ASP	0.169					
8	Lens 4	-45.017 ASP	0.340	Plastic	1.544	55.9	-7.59	
9		4.558 ASP	0.371					
10	Lens 5	7.345 ASP	0.400	Plastic	1.639	23.5	17.30	
11		21.428 ASP	1.521					
12	Lens 6	-2.704 ASP	0.499	Plastic	1.544	55.9	-8.63	
13		-6.797 ASP	-0.200					
14	Stop	Plano	0.500					
15	IR-cut filter	Plano	0.210	Glass	1.517	64.2	—	
16		Plano	0.413					
17	Image Surface	Plano	—					

* Reference wavelength is d-line 587.6 nm

* The effective radius of Surface 14 is 2.54 mm

TABLE 22

Aspheric Coefficients						
Surface #	1	2	4	5	6	7
k =	-5.6248E+00	1.0013E+01	6.9603E+01	7.1917E+00	-2.4360E+01	8.9690E+01
A4 =	1.4450E-01	-1.1902E-01	-1.5478E-01	-1.3207E-01	-1.3235E-01	-1.8991E-01
A6 =	-9.0903E-02	3.4401E-01	5.3452E-01	3.6570E-01	1.9876E-01	3.2715E-01
A8 =	6.3899E-02	-5.1746E-01	-7.5153E-01	-3.7892E-01	-2.0307E-02	-1.5146E-01
A10 =	-3.3089E-02	4.0165E-01	6.1750E-01	2.3795E-01	1.4762E-02	-6.1641E-02
A12 =	5.2355E-03	-1.6314E-01	-2.6560E-01	1.0689E-01	7.6958E-04	2.3724E-01
A14 =	-1.0086E-03	2.6794E-02	4.7083E-02	-1.3551E-01	-2.1530E-02	-1.3563E-01
Surface #	8	9	10	11	12	13
k =	1.5391E+01	-8.3513E+00	1.4261E+01	9.0000E+01	1.6777E-01	-1.9065E+01
A4 =	-1.9072E-01	-1.1131E-01	-1.3824E-01	-8.6454E-02	-1.0442E-01	-1.2712E-01
A6 =	4.8150E-01	4.1094E-01	1.6932E-01	9.1772E-02	1.0696E-01	9.0677E-02
A8 =	-5.5515E-01	-5.5591E-01	-9.5185E-02	-5.6137E-02	-6.1209E-02	-4.0454E-02
A10 =	2.8092E-01	4.0306E-01	2.6501E-02	3.3502E-02	1.9175E-02	9.7446E-03
A12 =	3.7067E-02	-1.5261E-01	-2.7971E-03	-1.5087E-02	-2.9573E-03	-1.1960E-03
A14 =	-4.9472E-02	2.5400E-02	-2.9446E-04	3.5445E-03	1.9328E-04	4.7399E-05
A16 =				-3.3490E-04	-2.3601E-06	2.2272E-06

In the 8th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 23 below are the same as those stated in the 1st embodiment with corresponding values for the 8th embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 21 and Table 22 and satisfy the conditions stated in Table 23.

TABLE 23

8 th Embodiment			
f [mm]	6.83	(f/R11) + (f/R12)	-3.53
Fno	2.82	f4/f3	-0.24
HFOV [deg.]	23.0	f/f4	-0.90
Nmax	1.639	T56/(ΣAT - T56)	1.64
(V2 + V3 + V5)/V4	1.26	tan(2 * HFOV)	1.03
CT4/CT5	0.85	SAG62/CT6	-2.09
T56/CT5	3.80	SD/TD	0.85
f/R1	4.07	BL/TD	0.18
R4/R3	-0.07	TL [mm]	6.20

9th Embodiment

FIG. 9A is a schematic view of an image capturing apparatus according to the 9th embodiment of the present disclosure. FIG. 9B shows, in order from left to right, longitudinal spherical aberration curves, astigmatic field curves and a distortion curve of the image capturing apparatus according to the 9th embodiment.

In FIG. 9A, the image capturing apparatus includes an image capturing lens system (not otherwise herein labeled) of the present disclosure and an image sensor 990. The image capturing lens system includes, in order from an object side to an image side, a first lens element 910, an aperture stop 900, a second lens element 920, a third lens element 930, a fourth lens element 940, a fifth lens element 950, a sixth lens element 960, an IR-cut filter 970 and an image surface 980, wherein an axial air gap is arranged between every two adjacent lens elements.

The first lens element 910 with positive refractive power has an object-side surface 911 being convex in a paraxial region thereof and an image-side surface 912 being convex

in a paraxial region thereof, which are both aspheric, and the first lens element 910 is made of glass material.

The second lens element 920 with negative refractive power has an object-side surface 921 being convex in a paraxial region thereof and an image-side surface 922 being concave in a paraxial region thereof, which are both aspheric, and the second lens element 920 is made of plastic material.

The third lens element 930 with positive refractive power has an object-side surface 931 being convex in a paraxial region thereof and an image-side surface 932 being concave in a paraxial region thereof, which are both aspheric, and the third lens element 930 is made of plastic material.

The fourth lens element 940 with negative refractive power has an object-side surface 941 being concave in a paraxial region thereof and an image-side surface 942 being concave in a paraxial region thereof, which are both aspheric, and the fourth lens element 940 is made of plastic material.

The fifth lens element 950 with positive refractive power has an object-side surface 951 being convex in a paraxial region thereof and an image-side surface 952 being convex in a paraxial region thereof, which are both aspheric, and the fifth lens element 950 is made of plastic material.

The sixth lens element 960 with negative refractive power has an object-side surface 961 being concave in a paraxial region thereof and an image-side surface 962 being convex in a paraxial region thereof, which are both aspheric, and the sixth lens element 960 is made of plastic material.

At least one of the first lens element 910, the second lens element 920, the third lens element 930, the fourth lens element 940, the fifth lens element 950, and the sixth lens element 960 has at least one inflection point.

The IR-cut filter 970 is made of glass, and will not affect the focal length of the image capturing lens system. The image sensor 990 is disposed on or near the image surface 980 of the image capturing lens system.

The detailed optical data of the ninth embodiment are shown in TABLE 24, and the aspheric surface data are shown in TABLE 25, wherein the units of the curvature radius, the thickness and the focal length are expressed in mm, and HFOV is half of the maximal field of view.

TABLE 24

(Embodiment 9)								
f = 6.58 mm, Fno = 2 60, HFOV = 20.0 deg.								
Surface #		Curvature Radius	Thickness	Material	Index	Abbe #	Focal Length	
0	Object	Plano	Infinity					
1	Lens 1	1.739 ASP	0.918	Glass	1.539	62.5	3.00	
2		-18.781 ASP	-0.036					
3	Ape. Stop	Plano	0.149					
4	Lens 2	234.391 ASP	0.295	Plastic	1.639	23.5	-5.71	
5		3.589 ASP	0.302					
6	Lens 3	10.249 ASP	0.442	Plastic	1.639	23.5	544.65	
7		10.382 ASP	0.219					
8	Lens 4	-5.118 ASP	0.387	Plastic	1.544	55.9	-7.66	
9		23.123 ASP	0.314					
10	Lens 5	7.149 ASP	0.301	Plastic	1.639	23.5	10.77	
11		-179.639 ASP	1.289					
12	Lens 6	-2.432 ASP	0.642	Plastic	1.544	55.9	-6.36	
13		-8.959 ASP	0.300					
14	IR-cut filter	Plano	0.210	Glass	1.517	64.2	—	
15		Plano	0.323					
16	Image Surface	Plano	—					

* Reference wavelength is d-line 587.6 nm

TABLE 25

Aspheric Coefficients						
Surface #	1	2	4	5	6	7
k =	-6.4689E+00	5.2957E+01	9.0000E+01	9.0663E+00	-4.6330E+01	8.5367E+01
A4 =	1.4124E-01	-1.1912E-01	-1.4845E-01	-1.1876E-01	-1.3515E-01	-1.8593E-01
A6 =	-9.1640E-02	3.4697E-01	5.3496E-01	3.6021E-01	1.9924E-01	3.2125E-01
A8 =	6.3731E-02	-5.1104E-01	-7.6093E-01	-3.7741E-01	-1.9814E-02	-1.5536E-01
A10 =	-3.0646E-02	4.0355E-01	6.1442E-01	2.3446E-01	1.7527E-02	-6.2209E-02
A12 =	6.2674E-03	-1.6736E-01	-2.5585E-01	1.0639E-01	1.5898E-03	2.3861E-01
A14 =	-7.0064E-04	2.8294E-02	4.2306E-02	-1.2887E-01	-1.9453E-02	-1.3319E-01
Surface #	8	9	10	11	12	13
k =	-6.3032E+01	3.7320E+01	6.2590E+00	-9.0000E+01	1.6355E-01	-7.8883E+00
A4 =	-1.8080E-01	-1.0575E-01	-1.8673E-01	-1.2389E-01	-1.0626E-01	-1.3464E-01
A6 =	4.8702E-01	4.1826E-01	1.7291E-01	9.8959E-02	1.0614E-01	9.2246E-02
A8 =	-5.4983E-01	-5.5918E-01	-9.2537E-02	-5.8680E-02	-6.1250E-02	-4.0290E-02
A10 =	2.7974E-01	4.0156E-01	2.6479E-02	3.3181E-02	1.9179E-02	9.7396E-03
A12 =	3.2962E-02	-1.5297E-01	-3.3038E-03	-1.4979E-02	-2.9589E-03	-1.2013E-03
A14 =	-5.3521E-02	2.4117E-02	-9.3375E-04	3.5135E-03	1.9333E-04	4.7189E-05
A16 =				-3.9033E-04	-2.0020E-06	2.1946E-06

In the 9th embodiment, the equation of the aspheric surface profiles of the aforementioned lens elements is the same as the equation of the 1st embodiment. Also, the definitions of these parameters shown in Table 26 below are the same as those stated in the 1st embodiment with corresponding values for the 9th embodiment, so an explanation in this regard will not be provided again.

Moreover, these parameters can be calculated from Table 24 and Table 25 and satisfy the conditions stated in Table 26.

TABLE 26

9 th Embodiment			
f [mm]	6.58	(f/R11) + (f/R12)	-3.44
Fno	2.60	f4/f3	-0.01
HFOV [deg.]	20.0	f/f4	-0.86
Nmax	1.639	T56/(ΣAT - T56)	1.36
(V2 + V3 + V5)/V4	1.26	tan(2 * HFOV)	0.84
CT4/CT5	1.29	SAG62/CT6	-1.11
T56/CT5	4.28	SD/TD	0.83

TABLE 26-continued

9 th Embodiment			
f/R1	3.78	BL/TD	0.16
R4/R3	0.02	TL [mm]	6.05

The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. It is to be noted that TABLES 1-26 show different data of the different embodiments; however, the data of the different embodiments are obtained from experiments. The embodiments were chosen and described in order to best explain the principles of the disclosure and its practical applications, and thereby to enable others skilled in the art to best utilize the disclosure and various embodiments with various modifications as are suited to the particular use contemplated. The embodiments depicted above and the appended drawings are exemplary and are not intended to be exhaustive or to limit

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the scope of the present disclosure to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings.

What is claimed is:

1. An image capturing lens system, comprising, in order from an object side to an image side:

- a first lens element with positive refractive power having a convex object-side surface;
- a second lens element with negative refractive power;
- a third lens element having an object-side surface and an image-side surface which are both aspheric;
- a fourth lens element with negative refractive power having an object-side surface and an image-side surface which are both aspheric;
- a fifth lens element having an object-side surface and an image-side surface which are both aspheric; and
- a sixth lens element having a concave object-side surface and a convex image-side surface which are both aspheric;

wherein the image capturing lens system has a total of six lens elements and an axial air gap is arranged between every two adjacent lens elements among the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element and the sixth lens element;

wherein an axial distance between the fifth lens element and the sixth lens element is T56, a sum of axial air gaps between every two adjacent lens elements is ΣAT , a focal length of the fourth lens element is f4, a focal length of the third lens element is f3, a focal length of the image capturing lens system is f, a curvature radius of the object-side surface of the first lens element is R1, an axial distance between the image-side surface of the sixth lens element and an image surface is BL, an axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD, a central thickness of the fourth lens element is CT4, a central thickness of the fifth lens element is CT5, and the following conditions are satisfied:

$$0.30 < T56 / (\Sigma AT - T56);$$

$$-4.0 < f4 / |f3| < 0;$$

$$3.30 < f / R1 < 9.50;$$

$$0 < BL / TD < 0.70; \text{ and}$$

$$CT4 / CT5 < 3.0.$$

2. The image capturing lens system of claim 1, wherein the sixth lens element has negative refractive power.

3. The image capturing lens system of claim 1, wherein the fifth lens element has positive refractive power.

4. The image capturing lens system of claim 1, wherein the object-side surface of the fifth lens element is convex.

5. The image capturing lens system of claim 1, wherein at least one of the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element and the sixth lens element has at least one inflection point, a maximum refractive index among the refractive indices of the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element, and the sixth lens element is Nmax, and the following condition is satisfied:

$$N_{\max} < 1.70.$$

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6. The image capturing lens system of claim 5, wherein the object-side surface of the fourth lens element is concave.

7. The image capturing lens system of claim 5, wherein the image-side surface of the fourth lens element is concave.

8. The image capturing lens system of claim 5, wherein the third lens element has positive refractive power.

9. The image capturing lens system of claim 1, wherein an axial distance between a stop and the image-side surface of the sixth lens element is SD, the axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD, and the following condition is satisfied: $0.70 < SD / TD < 1.10$.

10. The image capturing lens system of claim 9, wherein a focal length of the first lens element is f1, a focal length of the second lens element is f2, the focal length of the fourth lens element is f4, a focal length of the sixth lens element is f6, the focal length of the third lens element is f3, a focal length of the fifth lens element is f5, and the following conditions are satisfied:

$$|f1| < |f2| < |f4| < |f3|;$$

$$|f1| < |f2| < |f4| < |f5|;$$

$$|f1| < |f2| < |f6| < |f3|; \text{ and}$$

$$|f1| < |f2| < |f6| < |f5|.$$

11. The image capturing lens system of claim 9, wherein a curvature radius of an image-side surface of the second lens element is R4, a curvature radius of an object-side surface of the second lens element is R3, and the following condition is satisfied:

$$-0.20 < R4 / R3 < 0.40.$$

12. The image capturing lens system of claim 1, wherein the focal length of the fourth lens element is f4, the focal length of the third lens element is f3, and the following condition is satisfied:

$$-1.5 < f4 / |f3| < 0.$$

13. The image capturing lens system of claim 12, wherein the focal length of the fourth lens element is f4, the focal length of the third lens element is f3, and the following condition is satisfied:

$$-0.65 < f4 / |f3| < 0.$$

14. The image capturing lens system of claim 12, wherein the axial distance between the image-side surface of the sixth lens element and the image surface is BL, the axial distance between the object-side surface of the first lens element and the image-side surface of the sixth lens element is TD, and the following condition is satisfied:

$$0 < BL / TD < 0.30.$$

15. The image capturing lens system of claim 1, wherein the focal length of the image capturing lens system is f, a curvature radius of the object-side surface of the sixth lens element is R11, a curvature radius of the image-side surface of the sixth lens element is R12, and the following condition is satisfied:

$$-8.0 < (f / R11) + (f / R12) < -1.5.$$

16. The image capturing lens system of claim 15, wherein the focal length of the image capturing lens system is f, the curvature radius of the object-side surface of the sixth lens element is R11, the curvature radius of the image-side surface of the sixth lens element is R12, and the following condition is satisfied:

$$-8.0 < (f / R11) + (f / R12) < -2.5.$$

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17. The image capturing lens system of claim 1, wherein an Abbe number of the second lens element is V2, an Abbe number of the third lens element is V3, an Abbe number of the fifth lens element is V5, an Abbe number of the fourth lens element is V4, and the following condition is satisfied:

$$0.70 < (V2 + V3 + V5) / V4 < 1.50.$$

18. The image capturing lens system of claim 1, wherein the axial distance between the fifth lens element and the sixth lens element is T56, the sum of the axial air gaps between every two adjacent lens elements is ΣAT , and the following condition is satisfied:

$$0.85 < T56 / (\Sigma AT - T56).$$

19. The image capturing lens system of claim 1, wherein a distance in parallel with an optical axis from an intersection of the image-side surface of the sixth lens element and the optical axis to a maximum effective radius position on the image-side surface of the sixth lens element is SAG62, a central thickness of the sixth lens element is CT6, and the following condition is satisfied:

$$SAG62 / CT6 < -1.7.$$

20. The image capturing lens system of claim 1, wherein an Abbe number of at least one of the lens elements with positive refractive power is less than 28.0.

21. The image capturing lens system of claim 1, wherein half of a maximal field of view of the image capturing lens system is HFOV, and the following condition is satisfied:

$$\tan(2 * HFOV) < 1.20.$$

22. The image capturing lens system of claim 1, wherein an axial distance between the third lens element and the fourth lens element is T34, an axial distance between the

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fourth lens element and the fifth lens element is T45, and the following condition is satisfied:

$$T34 < T45.$$

23. The image capturing lens system of claim 1, wherein the central thickness of the fourth lens element is CT4, the central thickness of the fifth lens element is CT5, the axial distance between the fifth lens element and the sixth lens element is T56, and the following conditions are satisfied:

$$CT4 / CT5 < 1.7;$$

$$2.0 < T56 / CT5.$$

24. The image capturing lens system of claim 1, wherein the focal length of the image capturing lens system is f, the focal length of the fourth lens element is f4, and the following condition is satisfied:

$$-1.50 < f / f4 < -0.30.$$

25. The image capturing lens system of claim 1, wherein the first lens element, the second lens element, the third lens element, the fourth lens element, the fifth lens element and the sixth lens element are made of plastic material, an axial distance between the object-side surface of the first lens element and the image surface is TL, and the following condition is satisfied:

$$TL < 8.0 \text{ mm.}$$

26. An image capturing apparatus, comprising:
the image capturing lens system of claim 1; and
an image sensor.

27. An electronic device, comprising:
the image capturing apparatus of claim 26.

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